Railway Age

DAILY EDITION

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The past two years have marked a most striking development in the awakening appreciation of the need for better leadership among the supervisory officers and foremen of the mechanical department. This is not intended in any way as a criticism of the splendid and loyal service which has been rendered by these men in the past. It indicates rather a reflection of the growing appreciation in the industrial world of the importance of the human factor in industry. The railroad field has always been fortunate in attracting men to supervisory positions who had a considerable degree of natural executive ability. It has become recognized in industry in recent years, however, that management is a science and that successful leadership is based on very clear-cut and positive fundamental principles. The railroads, like most of the industries, have been so busy developing their physical plant that they have overlooked the necessity of providing special training for the foremen and supervisory officers in the art of leadership. There has been a pronounced awakening in this respect, however, during recent years and we now have foremen's clubs or foremen's educational or discussion meetings as a distinctive part of the program on several railroads. There would appear to be a splendid opportunity for the Mechanical Division to study these various developments, with the idea of formulating the best practices in this respect and helping to direct the tendencies along the best lines. The practices which have been followed with success in other industries might profitably be studied, with a view to seeing just how they can best be applied to raiload mechanical department conditions.

Training for Leadership

From the standpoint of the utilization of machine tools the car shop has at least one advantage over the locomotive shop. The large amount of repair work performed on cars of the same or similar classes enables production or manufacturing methods to be applied to a greater extent in the average car shop than in shops devoted exclusively to locomotive repair work. A single series of steel cars going through the shop for classified repairs, for example, will usually require the renewal of a large number of small pressed steel shapes that can be made on a quantity production basis. Machining car axles and wheels and repairing air brake parts are also operations which lend themselves to organized production methods. In many respects the output of the entire car shop is dependent on the efficiency of the wheel and forge shops, and if these shops do not turn out the work fast enough there will be a serious delay in getting cars repaired. The importance of having adequate hydraulic presses, punches and shears, modern wheel presses, axle lathes and car wheel borers to get out the work can hardly be over-emphasized. There are a number of machine tools adaptable to car machine shop work on exhibition this year and a big opportunity is presented to car department men to look these machines over and see how they compare with those now being used. In addition to improved machines there have been a number of important developments in the work of reclaiming triple valves, angle cocks and other air brake material. The utilization of the internal grinder for such work has already shown good results. Many economies can be effected by the installation of production machinery in the car shop and the important influence of this machinery on shop output makes it worthy of the careful consideration of car shop men.

Machine Tools in the Car Shop

An examination of passenger train cars which have been built recently, and a comparison with those constructed a number of years ago, shows a marked advance in everything that contributes to the safety of the traveling public. Much, also, has been done to provide increased comfort to passengers. Less attention apparently has been given to matters that appeal to the aesthetic or artistic sense. An increasing number of people, however, are becoming more and more susceptible to such sensations and a growing recognition of this fact is evinced by improvements in the architecture and the interior finish of our homes, hotels and public buildings. In some instances it is apparent that those responsible for car design have given some thought to this phase of the question and in the future the tendency doubtless will be much more pronounced. First cost, durability and maintenance are by no means everything that should be considered in connection

Interior Finish of Passenger Cars is Important

with the interior finish. Whatever will add even to the unconscious comfort of the passenger is of importance. It is for this reason that attention is paid to the design of seats; to heating, ventilating, lighting, painting and interior finish in general. Head-linings and the general color schemes should, of course, be of such a character as to render lighting most effective. Dining, parlor and sleeping cars admit of greater latitude in treatment of finish than is possible in ordinary coaches, and in some few instances really distinctive and pleasing results have been worked out for such cars. However, the whole question of the details of interior finish is so outside the scope of the ordinary car designer, who is called upon to wrestle with so many other vitally important problems, that it may be found necessary to develop some new experts in this branch or to call for assistance from those who have shown the requisite ability in other than railroad car work.

Is the Convention Worth While?

According to the latest figures 2,766 railway men registered during the convention this year, which is 427 more than the registration at the 1922 convention. Unquestionably, each of these men came to the convention with some problem of railroading on his mind. The exhibits, combined with the reports and discussions at the conventions, offered a splendid opportunity for these men to obtain suggestions as to the solution of their particular problems. The main object of the exhibit and convention is to bring to the attention of railway men the latest developments in railway appliances and to present to them the results of the organized study of the picked talent of North American railways. Probably no one will leave Atlantic City in whose mind at least one new idea of constructive value has not been thoroughly crystalized and the foundation of new knowledge laid for many others. If no more than this has been accomplished the convention and exhibit has been fully justified.

One Way To Conserve the Coal Pile

That the costs of transportation are considerably increased by the enforced haulage of unnecessary dead weight is a fact well recognized by all railroad mechanical men, even though no one has been able to make an exact calculation and thus reduce the amount to dollars for any volume of traffic or period of time. The proportion existing between the light weight of a freight car and its revenue-earning load is important and usually is given considerable attention when the design of a new car is being prepared, provided the preparation of the design is not left too much to the builder and is not postponed until the question of the earliest possible delivery overshadows all consideration of engineering details. The value of careful designing on initial costs, maintenance and net revenue-earning capacity are well recognized, theoretically at least. In the future an insistance upon this point by mechanical officers should command attention and result in effecting some marked economies. An examination of the work that has been done by the Committee on Car Construction shows that, while structural strength and the factors that affect maintenance have been given careful attention, the economies of car design have not been overlooked or considered to be of minor importance. This is strikingly evidenced by the fact that the new sample Pennsylvania all-steel box car, although of slightly increased cubic capacity, has a weight which is 1,300 lb. less than that of the U. S. R. A. single sheathed cars. This is a gain which, as time goes by and an increasing number of cars of the new and improved design are put in service, will effect an appreciable reduction in fuel bills. Fuel economies, as will be seen, are as worthy of consideration by the car man as by the locomotive man. Only by both groups working together for the same end can the railroads and the general shipping public also derive the greatest benefit.

Applications of Fusion Welding

Further progress was made yesterday by the Mechanical Division in establishing the proper use of fusion welding on the railroads. The report on that subject was both constructive and comprehensive. It suggested the further restriction of welding in some instances and its extension in others. It conveyed the thought that it was necessary to maintain seemingly unnecessary restrictions until such time as requirements for each application are generally understood and conditions established that will make welding applications uniform, particularly for equipment that is interchanged. The discussion indicated an earnest desire to make full use of the advantages of welding within the limits of safety. Continued study of welding applications, with assistance from outside organizations or laboratories in a position to gather information on special scientific subjects suggested by the Mechanical Division, will assure steady progress and dependable results.

An Unusual Event

THERE ARE almost 2,000 mechanical department apprentices on the Santa Fe System. The apprentice department was organized 17 years ago, and ranks as by far the best one on any railroad—it is doubtful if it can be equaled by any apprentice training system in the industries. The Santa Fe apprentice department took the front rank many years ago because of its constructive and effective program, and has been steadily improving year after year. It has been the practice for several years to hold annual get-together meetings of the apprentice instructors. A month ago 72 of them held a four-day meeting at Albuquerque, N. M. There are two reasons for holding these meetings. The first is to compare methods and practices at the different shops, so that the entire organization may benefit from the good things that may be developed during the year at any one point. It must, of course, be understood that the apprentice training methods are pretty well standardized and that the office of the general supervisor of apprentices keeps in intimate touch with all of the instructors. Naturally it would hardly be wise for any one shop to depart from the standards which have been developed. On the other hand, there are many possibilities for testing out special methods and of making improvements which do not conflict with the standard practices. It is not difficult to understand the constructive value of a get-together meeting of this sort, participated in by 72 men who are keenly alive to the possibilities of their work, and who are constantly studying how to get better results.

The second reason for holding these meetings is that the apprentice instructors are largely Santa Fe graduate apprentices. The experience which they gained as apprentice instructors seems to fit them admirably for line positions, such as foreman, etc. An evidence of this is the fact that within the 12 months between the two last get-together meetings so many of the instructors were promoted that it was necessary to secure 18 new ones, or 25 per cent. of the total number. The get-together

meetings afford a splendid means of assisting these new men to get a better understanding of the work as a whole, and to inspire them to put forth their best efforts. It is interesting to note that Santa Fe apprentice graduates who were also apprentice instructors on that system, are now in charge of apprentice instruction on several railroads, including the Duluth & Iron Range, Duluth, Missabe & Northern, El Paso & Southwestern, Kansas City Southern, Los Angeles & Salt Lake, and the Missouri-Kansas-Texas. Four of these supervisors of apprentices attended the meeting at Albuquerque, and took part in the discussion. The Santa Fe instructors were represented at the Atlantic City meetings by one of their number who was elected to represent them at the Mechanical Division convention.

Straight Line Car Repairs

THE ATTENTION car department men are giving to "straight line" methods of operating repair shops holds much of promise for the more efficient and economical performance of this important phase of maintenance-of-equipment work. The days are, or should be, past when freight cars can be taken into the shop indiscriminately without regard to type or class of repairs and worked on spasmodically by all-around car men, who may know all phases of car repair work, but be specialists at none. The days are past when a railroad can afford to allow a gang of "car knockers" to start on a freight car, truck their own material on hand cars and perhaps work up more or less of this material at the car. Labor costs are too high to permit of this practice. It costs too much to hold the cars out of service. In an address Monday morning, Commissioner McManamy referred to this, stating that the interest and depreciation charges on an ordinary box car are approximately equal to the per diem charge of one dollar a day, and that the cost of keeping a car standing idle for one day is equal to the revenue earned hauling one ton of freight 100 miles.

The essentials of "straight line" car repairs are extremely simple and are justified by the rules of common sense. Two options are offered. Specialized gangs may move over a string of cars, performing the major operations from stripping to stenciling in the proper sequence, or perhaps better still, the cars may be advanced from station to station past the gangs, each of which has a permanent location with its tools and equipment conveniently placed. The essential thing is to have each major operation on the cars performed by a gang especially trained for the work and with tools, equipment and as much working material as possible within arms' reach. Moreover the material should be fabricated so that when the car man gets it, it will fit. With attention to these details an immense amount of lost motion in repairing cars can be eliminated. Lost motion in any business or industry is the primary cause of reduced output and high unit labor costs.

An incidental but important advantage of the straight line method is the possibility of arranging for repairs to be made to two or more strings of cars simultaneously, with the gangs so divided as to form competing units. This plan has already been tried with highly desirable results, the car men seeming to take a new interest in their work and actually accomplishing more, with less effort, under the stimulus of competition. New car shops such as those of the D. & R. G. W., at Denver, Colo., have been designed with particular reference to the use of the straight line method which is also adaptable with modifications to existing car shops.

A Record-Breaking Convention

A TOTAL OF 7313 were registered, at the convention; this is 1059 above the total registration of the convention in 1922. Two years ago, however, the annual convention of the Air Brake Association was held at Atlantic City and its members were included in the totals for that year.

Of the total registration this year 1221 were members of the Mechanical Division. This exceeds the last convention's total by 213. If the attendance at the Purchases and Stores Division is added to the Mechanical Division attendance, together with the special guests, all of whom are railroad men, the grand total of railway men attending the present convention is 2766. This is 96 more than the number of supply men registered, the latter figure being 2670. We believe it is the first time in the history of the convention that the total number of actual railway men exceeded the number of suppl men. Below is a comparison of the total registrations for the last two conventions, the figures for the conve tions previous not being available.

	1922	1924
Members, Mechanical, A. R. A.	1008	1221
Members, Purchases and Stores	384	434
Special guests	947	1111
Supply men	2304	2670
Railroad ladies	1036	1201
Supply ladies	575	676
Total	6254	7313

Registration

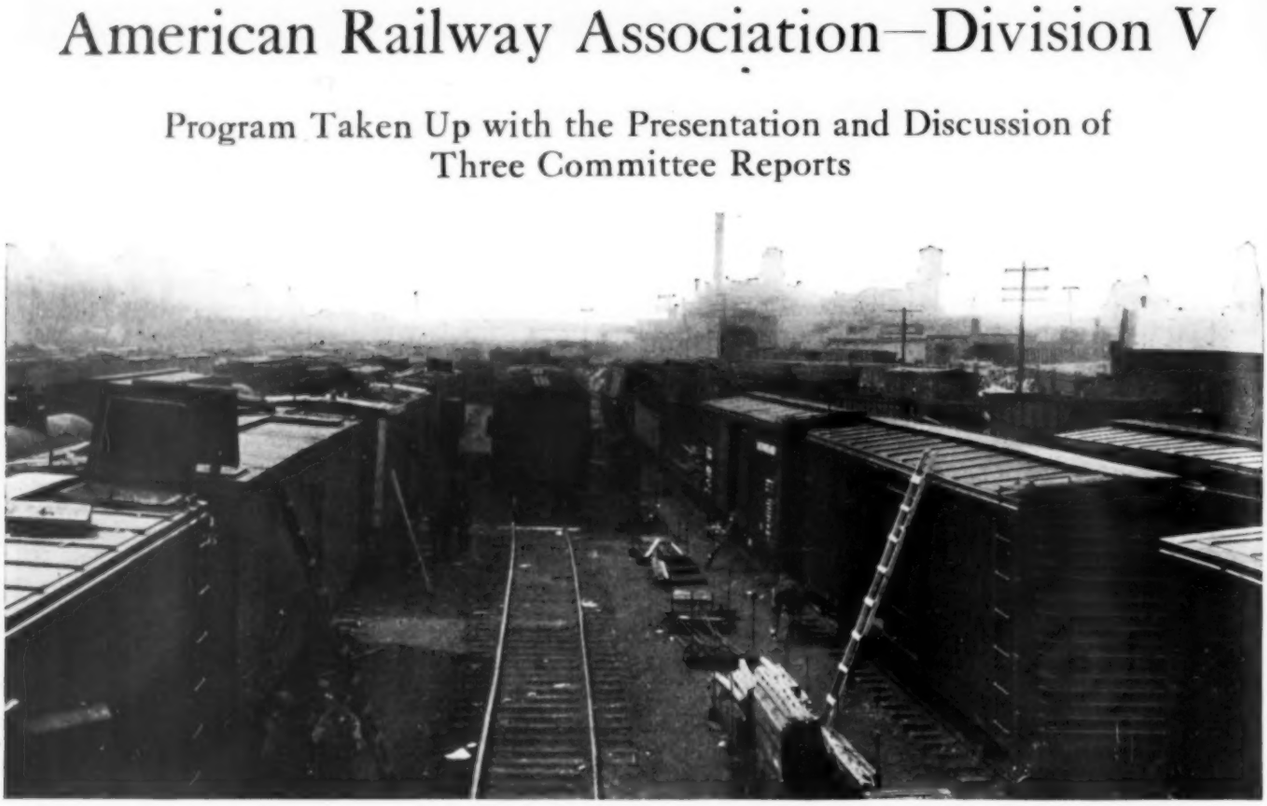
Special Guests

Adams, F. L., Asst. Examiner, U. S. Patent Office.
Appleton, W. H., For., Penna.
Barndt. Ardnor, Engineer, P. & R.
Bell, W. G., Sig. Supvr., Penna.
Billstein, A. E. F., Asst. Sig. Supvr., Penna.
Blankfield, A. B., Elect., W. J. & S. S.
Bradley, J. F., Penna.
Crawford, H. W., For., Penna.
De Carlo, Joseph, Penna.
Deck, Geo. H., Eng., P. & R.
Dick, W. R., Power Director, W. J. & S. S.
Faust, Wm., P. & R.
Franey, J. L., For., Penna.
Graeff, A. N., P. & R.
Green, E. R., Sheet Metal Worker, Penna.
Hamm, C. A., Asst. R. F. E., P. & R.
Hann, H. F., Engineer, P. & R.
Harbay, M. B., Traymore.
Holcombe, R. M., G. F., Penna.
Johnson, Milton, Penna.
Maddox, H. J., Machinist, Penna.
McBride, J. J., Machinist, Penna.
McElroy, Frank, Ch. Cl., Union Tank Car.
McErlane, M., Asst. For. B. M., Penna.
Miller, R. D., Penna.
Mills, J. S., For., L. I.
Minnick, Oscar W., For. Car Insp., P. & R.
Minter, G. D., Car Insp., N. & W.
Ocksude, C. C., Asst. For., P. & R.
Oler, B. F., Sig. Insp., Penna.
Ortner, J. L., Field Agt., Erie.
Praster, D. W., Tel. Oper., Fenna.
Ricker, H. J., Crew Dispatcher, P. & R.
Runkel, W. H., Eng., Union Tank Car.
Schroeder, S. J., For., Penna.
Sharp, H. H., Car Insp., Penna.
Squier, C. W., Eng. Mech. Dept., B. R. T.
Stanwood, W. E., Stockman, Penna.
Theil, Arthur, Penna.
Wast, H. T., Carman, Penna.
Whiteman, H., For., P. & R.

(Other registrations will be found on page 1750.)

American Railway Association—Division V

Program Taken Up with the Presentation and Discussion of Three Committee Reports



THE SIXTH, and final session, of the Mechanical Division Convention was called to order yesterday by the chairman, J. J. Tatum, at 9:40 a. m.

The program for the day was made up of committee reports on the following subjects: Autogenous and Electric Welding; Brakes and Brake Equipment, and the report of the Committee on Wheels.

W. R. Scott, president of the Southern Pacific Lines, was to have delivered an address at this session but, unfortunately, was not able to be present.

Autogenous and Electric Welding

Welding or heat cutting will impart internal stresses to the base material which are in approximate direct ratio to the carbon content and in inverse ratio to the original temperature of the base material. These stresses are produced by the local transformation of structure, which is caused by heating the surface metal to a temperature above the recalescence point and the underlying cold base metal acting as a quenching medium. Under normal conditions any detrimental effect on the base material can be removed by subsequent annealing or sufficiently high preheating. Welding or heat cutting on medium or medium-high carbon steel should be done only under careful supervision. In no case should any such welded or cut material go into service without full assurance that the entire part was annealed at a temperature above the recalescence point of the steel, or the effected zone was removed by machining.

J. T. Wallis
Chairman

Steel, steel tired wheels and axles all come under the class of medium high carbon steel. The typical effect of electric and gas welding on tires is represented by Figs. 1 and 2, that show etched transverse sections. The variation in the physical properties derived from the scleroscope hardness of the different areas, can, in the case of electric welding (Fig. 1), be roughly divided into the following six zones:

Zones	Scleroscope hardness	Brinell hardness	Ultimate strength, lb. per sq. in.
A (original material)	33.0	224	112,450
B	45.0	306	158,600
C	42.5	289	145,100
D	37.6	256	128,500
E	34.4	234	117,450
F	18.4	125	62,750

The difference in the physical properties of zones B, C, D, and E, was evidently due to the order in which the various layers of filler metal had been applied, the hardest zone being produced under application of the filler metal while the base material as relatively cold. This acts as a more severe quenching medium against the zone heated by the arc than in such cases where the tire had been to some extent preheated by the previous welding. In this case the maximum increase in hardness and strength of the base material due to the transformation of

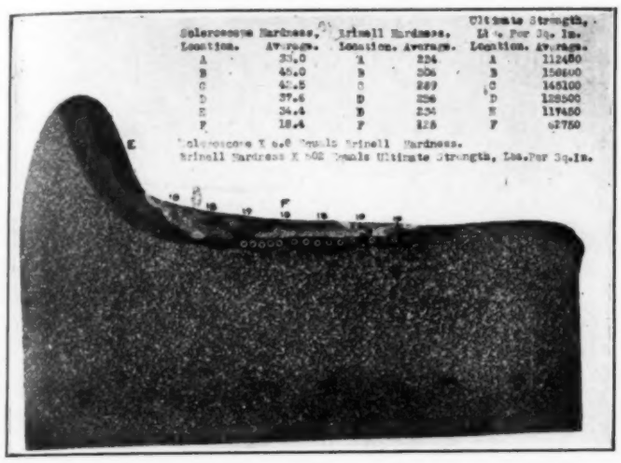


Fig. 1—Transverse Section Through a Locomotive Tire with Flat Spot Welded By the Electric Process

the structure by the welding was approximately 40 per cent and the hardness of the applied low carbon metal was approximately 55 per cent of the original hardness of the tire material.

The structural transformation of tires by gas welding (Fig. 2) showed a reverse condition. The heat imparted to the base material has a slower penetration than the electric arc and instead of increasing the hardness and strength in the transformed zones, the physical properties were lowered as a re-

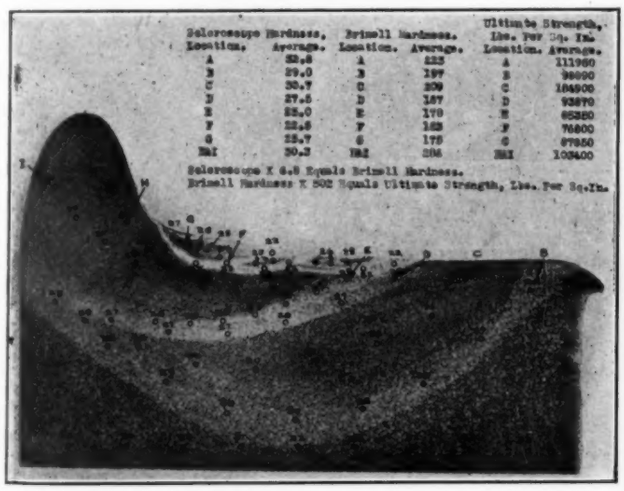


Fig. 2—Transverse Section Through a Locomotive Tire With Flat Spot Welded By the Gas Process

sult of annealing by the slow application of the heat. The following table shows the variation in hardness obtained under this process of welding:

Zones	Scleroscope hardness	Brinell hardness	Ultimate strength, lb. per sq. in.
A (original material)	32.8	223	111,950
B	29.0	197	98,890
C	30.7	209	104,900
D	27.5	187	93,870
E	25.0	170	85,350
F	22.5	153	76,800
G	25.7	175	87,850
H and I	30.3	206	103,400

The hardness of the filler metal itself is approximately the same for the gas and the electric welds. But by the comparison of the two plates the gas weld shows distinct decarburized zones forming the junction between the applied filler metal and the base material.

Rolled Steel Wheels

Similar conditions as found in tire steel exist for rolled steel wheels as shown in Fig. 3, which represent a weld made by the gas method. The top view on this figure shows the condition of the steel after welding which was not followed by annealing, the lower view representing the same weld after annealing.

A typical service failure of a tire due to local heating produced by welding, is represented by Fig. 4. It developed that through some error on the part of the shops, the retaining shoulder had been turned off and in order to save the tire, four short sections of the retaining shoulder at quadrant locations were built up by means of the electric welding process. It was not annealed subsequent to welding. The four fractures, all developing from the built up sections, afford positive evidence that the high internal stresses produced by the welding were the direct cause of the failure.

It has to be considered that the applied filler metal, either carbon or alloy steel has, in most cases, different hardness and physical characteristics than the base material. Moreover, with the gas welding process a pronounced decarburized area is formed between the base material and the filler metal. With this type of welding it is very probable that the filled in aeras will readily slough out by parting along the decarburized zone. Against this the electric weld has the pronounced disadvantage that unless a rather deep penetration of the heat is obtained, with consequent increase of internal stresses, the filler metal will not adhere properly.

A similar condition of structural transformation due to the welding heat, exists on axles where the carbon ranges above 0.30 per cent. Figs. 5 and 6 show worn fillets that have been

Fig. 3—Transverse Section Through the Rim of a Rolled Steel Wheel With Flat Spots Welded By the Gas Method Top, Before Annealing; Bottom, After Annealing.

built up by means of the electric and gas welding processes, respectively, without preheating or annealing subsequent to welding.

The transformation in structure with corresponding internal stresses at points in an axle where bending stresses of any magnitude occur, will readily permit development of detail fractures, and welds cannot be permitted on any part of the axle, with the exception of the building up of end collars where practically no bending stresses exist. Such welding may be done without preheating or annealing by the electric welding method. The gas method is not recommended unless it is controlled so as to avoid the possibility of excessive heating during welding. This may, if not properly controlled, cause the transformation of the structure at the point where bending stresses occur.

Fig. 7 represents the service failure of a railroad motor car axle. The fractured face shows a distinct progressive failure starting from the zone of applied filler metal. The longitudinal etching shows the pronounced structural transformation which

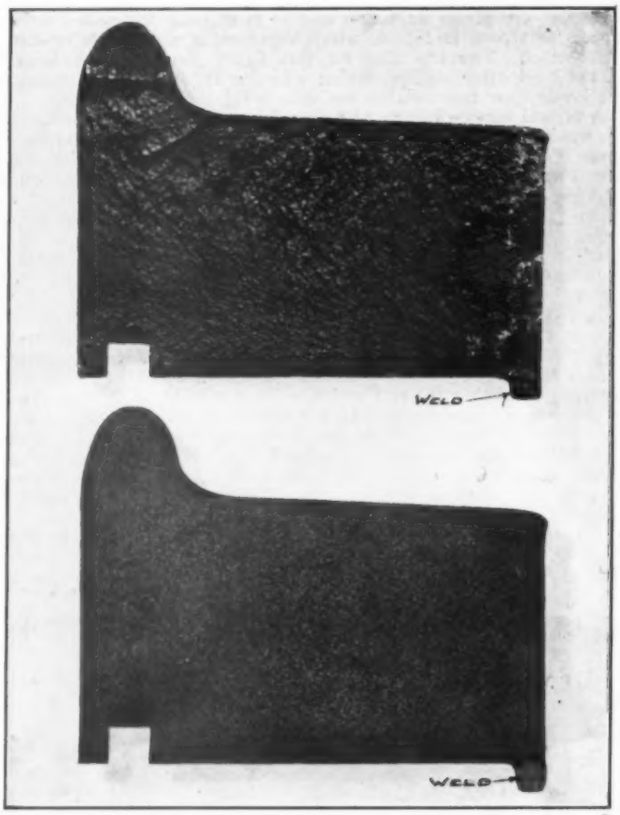


Fig. 4—Service Failure of a Tire Welded By the Electric Method

caused the internal stresses. This was evidently the direct cause of, the rupture. Evidently the axle was not preheated or annealed after welding.

Numerous experiments were made to determine the physical characteristics of welded cast steel on rectangular specimens approximately ¾ in. in thickness. All welds were made by the double bevel method. All specimens were annealed and the reinforcement removed prior to testing. The following average results represent the physical properties of welds on which, upon

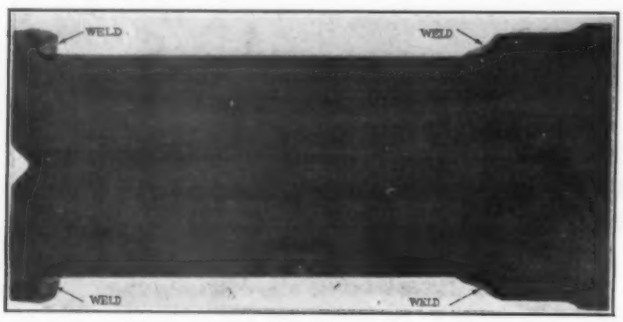


Fig. 5—Longitudinal Section Through a Car Journal Welded By the Electric Method

examination of the tensile fracture, the welding was considered as a good mechanical job.

	Lb. per sq. in.		Elongation in 2 in. across weld,
	Yield point	Ult. strength	per cent
Electric welding method.	32,500	47,000	5
Gas welding	34,000	52,000	12
Original material	35,000	70,000	27

The quality of the gas welds could still further be improved by the use of alloy welding wire, such as nickel steel. Although the welds were made in all cases by experienced operators, the physical properties obtained were of wide variation, due to oxide inclusions, blow holes and non-fused areas. This non-uniformity necessitates a margin of safety, which can only be obtained by proper reinforcing of the weld. Inasmuch as such reinforcement on coupler parts, in most cases, would interfere with the proper operation, the ruling that welding of cracks in coupler

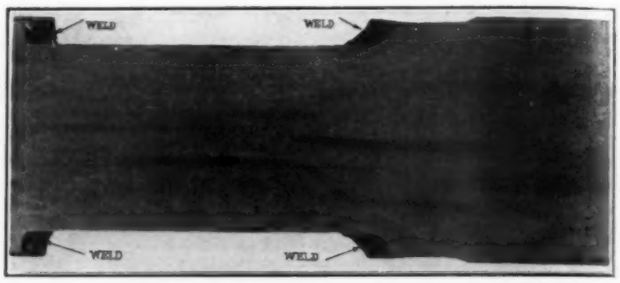


Fig. 6—Longitudinal Section Through a Car Journal Welded By the Gas Method

bodies, knuckles, knuckle pins, locks, lifters and throwers, be prohibited, as given in the committee report of 1919, should be sustained.

Low Carbon Steel

On low carbon steel the transformation of structure due to the welding heat is not very severe and while it is desirable to remove all local transformation of structure by annealing, the service stresses of the welded member, in a number of cases, are such that welding may be done without subsequent annealing. The general rule, however, applies that on account of the more gradual application of heat by the gas welding method, the transformation in structure is less abrupt and the internal stresses

Fig. 7—Service Failure of a Railroad Motor Car Axle Through the Inside Fillet of the Journal—This Axle Was Built Up By the Electric Method

imparted to the material are not as severe as those obtained by the electric welding method. The fusion obtained by the gas welding method is better and the filler metal shows less slag and oxide inclusion than the filler metal applied by the electric welding process. These conditions are represented by Fig. 8.

Wrought Iron

On account of the negligible carbon content in wrought iron, no local change of the parent metal can be noticed and annealing after welding is not necessary. This condition is shown by Fig. 9. This sample was not annealed after welding.

While it is possible to weld wrought iron by either the gas or electric method with relatively small reinforcement, the yield and ultimate tensile strength closely approximates the strength of the bar itself and the filler metal shows practically no ductility. Fatigue tests on specimens of uniform cross-section, welded and non-welded, wrought iron bars, tested under identical conditions

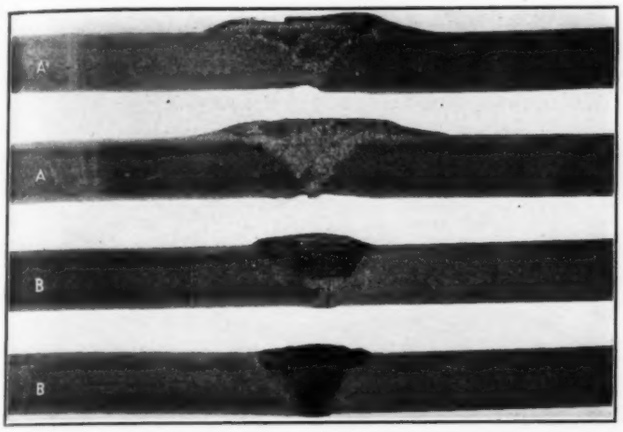


Fig. 8—General Appearance of Firebox Steel Specimens; A Welded By the Gas Method; B—Welded By the Electric Method

of deflection, showed the resistance of the welded section against vibratory stress, to be approximately 50 per cent of the non-welded bars. The gas welds are slightly superior to the electric welds. Welding of cracks cannot be permitted on wrought iron, such as in arch bars, where the resistance to vibratory stresses is of prime importance. Worn places may be built up by either the gas or the electric welding method, provided the original cross-section of the bar has not been reduced below a specified

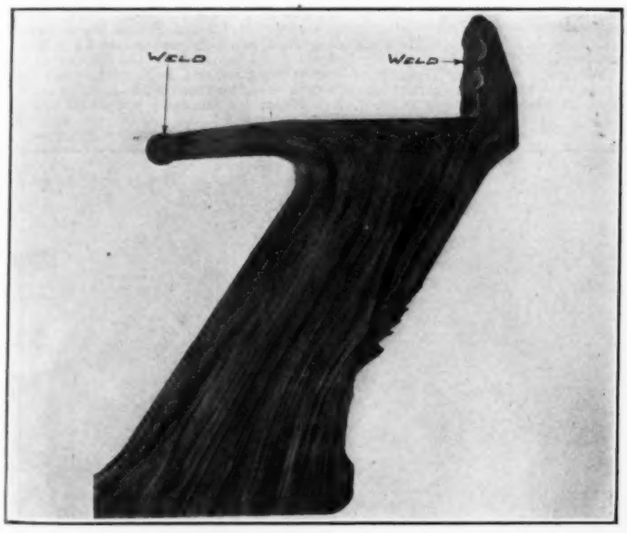


Fig. 9—Radial Section Through a Valve Spool Follower that Was Welded By the Electric Method

minimum, and where the built up parts are subjected to vibratory stresses it is preferable to anneal subsequent to welding.

Cast Iron

All cast iron parts, with the exception of cast iron wheels, may be welded. The gas welding method should be used wherever possible. One hundred per cent welds can be readily obtained without reinforcement by proper preheating and cooling of the material and using cast iron welding sticks. Figs 10, 11, 12 and 13 show a cylinder welded by the gas method. If it is necessary to use the electric welding method on account of the impossibility of preheating the material, the fractured faces should be properly studded prior to welding and wrought steel or iron welding sticks used. However, this method of welding should only be used in special cases and not as a common practice.

Welding of flat spots on cast iron wheels, Fig. 14, produces a similar condition to that found on welded wrought steel wheels

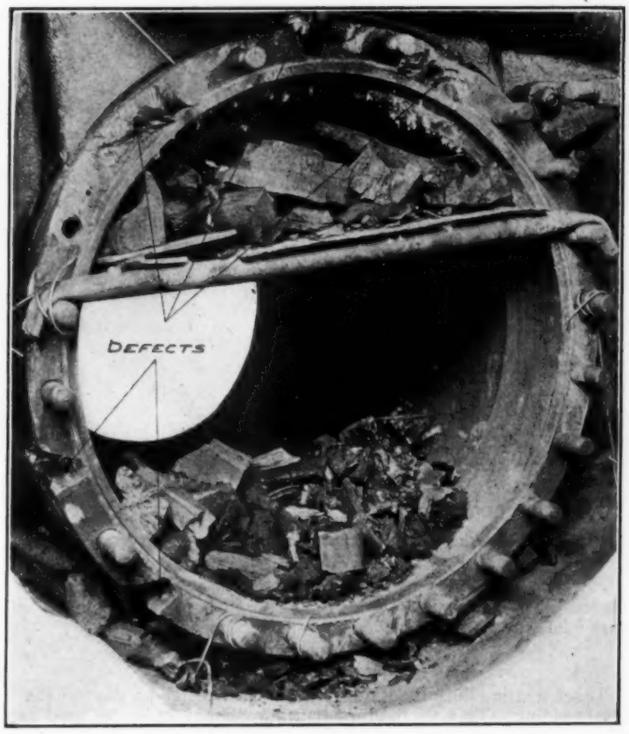


Fig. 10—Locomotive Cylinder Arranged for Preheating

and tires. The welding heat causes a distinct change in structure of the material adjacent to the weld. Moreover, on account of the relatively high internal stresses, which exist in all chilled cast

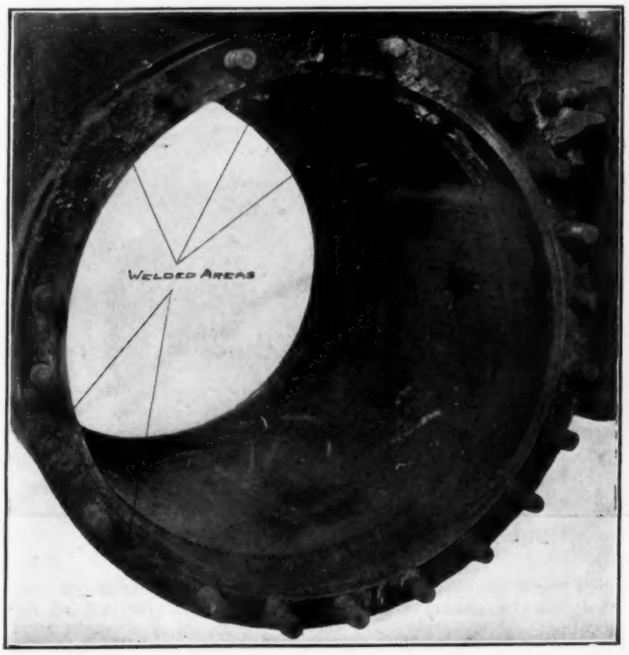


Fig. 11—Ruptures in a Locomotive Cylinder Welded By the Gas Method

iron wheels, such welding could only be done by careful preheating the wheel, followed by uniform cooling. Heat applied locally causes cracks through the chilled area similar to the cracks produced by excessive brakeshoe action, or even an entire

rupture of the wheel. It is doubtful whether cast iron wheels can be properly preheated and then cooled after welding. If this were done, wheels in a state of highly unbalanced stresses would be

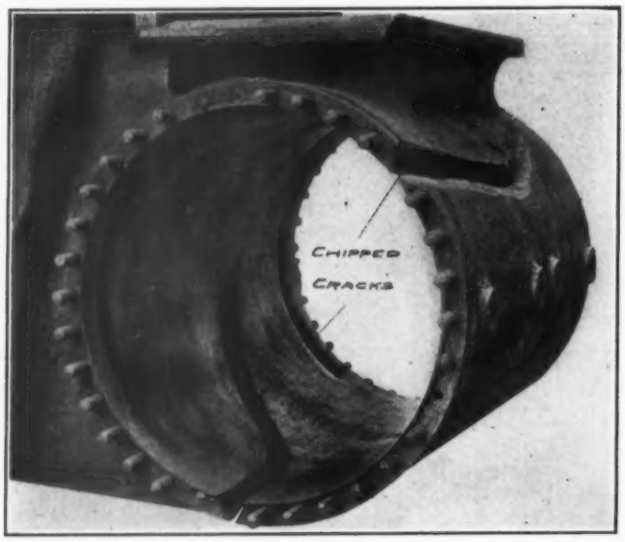


Fig. 12—Cracks in a Locomotive Cylinder Prepared for Welding

placed in service. We, therefore, recommend that welding on cast iron wheels be prohibited.

Torch Cutting

Torch cutting has the same effect on material as gas or electric welding. This method of cutting should only be used on steels above 0.25 per cent carbon when the transformed zone,

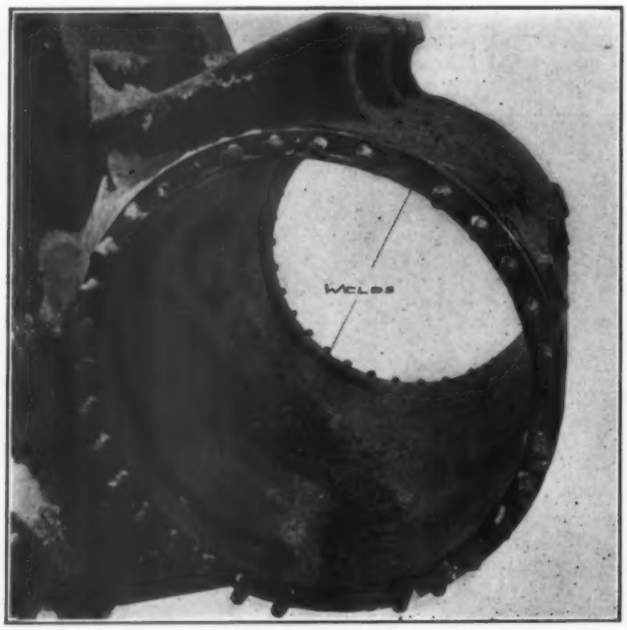


Fig. 13—Cracks Welded By the Gas Method

which increases in depth with the increase in thickness of material, can be either removed by machining or be reduced by annealing. An example of a service failure of a wrought steel wheel on which the lathe carrier holes had been made by means of a cutting torch is shown in Figs. 15 and 16. Some of the cracks, before being discovered by inspection developed to such an extent as to cause complete rupture of the wheels.

Recommendations

Your Committee recommends the following revision of the gas and electric welding limits and regulations of the 1919 report.

Section II

Welding cracks or fractures will not be permitted on the following: Add to the list, main air reservoirs, brake levers, crank pins, draw bars and safety bars, grab irons, rods,—main, side, piston, valve and all forgings in rod shape constituting valve motion work,—and steps or step straps of wrought iron or wrought steel.

Change the wording, "car wheels and tires," to "Wheels or tires (including cast steel or cast iron centers)."

Section III

Building up of worn surfaces will be permissible on the following: Add to the list, axles (building up of end collars, the electric welding method preferred), buffer castings, cross heads, and cross head guides. Cast iron,

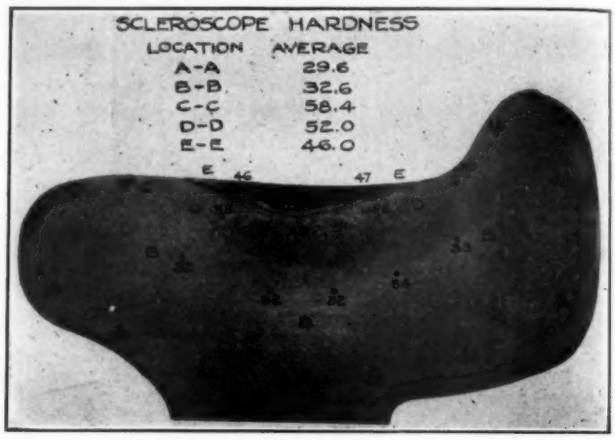


Fig. 14—Transverse Section Through a Rim of a Cast Iron Wheel—Flat Spots Were Welded By the Gas Method

except cast iron wheels; any gray iron casting, including cylinders, may be built up by the gas welding method; the electric welding method can be used, but only in such cases where stresses are negligible. Miscellaneous cast steel may be welded by either the gas or electric method. Draft castings, driving boxes, truck equalizers, locomotive frames, frame brace castings, links and blocks (other than alloy steel) and the valve rod fit to the cross head.

Change the wording, "Spring or bolster hangers, and holes in levers," to "Spring or bolster hangers (for wrought iron and wrought steel of less than 0.25 per cent carbon content, it will not be necessary to anneal after

Fig. 15—Service Failure of a Wrought Steel Wheel By Fractures Starting from Holes Burnt in the Plate

welding). Holes in levers (for wrought iron and wrought steel of less than 0.25 per cent carbon content, it will not be necessary to anneal after welding)."

Remove from the list, "Flat spots on rolled steel wheels or tires if thickness of tread is 1 in. or more above limit of wear groove."

Section IV

Welding cracks or fractures will be permitted on the following: Add to the list, buffer castings, Cross Heads (except in the neck and wrist pin hole or any part of the crosshead under similar stress). Cast iron, including cylinders, all gray iron castings, except cast iron wheels, may be welded by the gas welding method. Cast Steel, all miscellaneous steel castings not subjected to high tension or bending stresses may be welded by the gas, electric, thermit or liquid steel method; castings subject to high stresses may be welded if the crack is less than 40 per cent of the cross sectional area. Locomotive frames, frame brace castings, guide yokes (gas welding method

Fig. 16—Section Through a Hole Burnt in a Wrought Steel Wheel With Progressive Fractures Starting from the Hardened Zone

recommended) and piston heads. Pipes, steam and air, and welding of longitudinal splits. Pipe fittings, (gas welding method should be used). Wheel centers, cast steel or cast iron.

Permissible limits for boiler and fire box welding.—Boiler braces: no welding permitted. Barrel sheets: no welding is permitted if the weld is under any stress. Welding may be used at the end of the seam under the butt strap to stop leakages and for similar purposes, but never as a substitute for the riveted joint or any part thereof. Domes, no welding permitted. Combustion chambers: Generally speaking, on fully stayed surfaces, cracks may be welded or patches applied, but when a sheet carries great stresses, no welding shall be done. Crown sheets: No welding in crown sheets shall be permitted, except that the crowns may be welded to the side sheets, flue sheet, door sheet or combustion chamber. If the side sheets are welded to the crown sheet, the welds must not be higher than 12 in. below the high point of the crown. Door sheet: Welding permitted, but no welding of cracks or patch welding shall be done at a point higher than 12 in. below the highest point of the crown. The bottom weld of any patch shall preferably be located not lower than above the bottom row of staybolts. Short cracks not extending further than the distance between three staybolts may be welded. Flue sheet, front: Welding will be permitted at any point within the circle formed by the fillet connecting the flat portion of the sheet with the flange. Flue sheet, back: Welding permitted, but no welding of cracks or patch welding shall be done at a point higher than 12 in. below the highest point of the crown unless reinforced on the water side. Head, back: Welding permitted if the height of the patch does not exceed 50 per cent of the distance from the mud bar to the roof sheet seam; except that the height of the patch may extend to cover two rows of staybolts above the door opening; on patches applied to the side sheets and back head, the bottom line of weld shall preferably be located not lower than above the bottom row of staybolts. Side sheet, inside: No restriction, provided the patch does not extend to a point higher than 12 in. below the high point of the crown. The bottom weld of the patch is preferably located above the bottom row of staybolts. Throat sheet, outside: Welding is permitted if the patch is not closer at any point to the roll at the throat than 50 per cent of the distance from the same point on the roll through the same point on the patch to the mud ring; welding will not be permitted in the bends; on flat surfaces, short cracks not extending further than the distance between three staybolts may be welded. Throat sheet, inside: Welding is permitted. Wrapper sheets: No welding is permitted, except for building up holes, on roof sheets; no welding is permitted on hip sheets. Application of patches on side sheets by welding is permitted, provided the height of the patch does not exceed 50 per cent of the distance from the mud bar to the roof sheet seam. The bottom weld of any patch shall preferably be located not lower than above the bottom row of staybolts. For welding the boiler and fire boxes, the electric method is recommended, on account of the less amount of heat imparted to the sheet when compared with the gas welding method and the subsequent smaller amount of expansion during welding. The following general rules shall apply: The edges of the sheets or cracks shall be properly prepared by chipping or machining; The cutting torch shall not be used for this work; Vertical welds shall be avoided and all patches shall have rounded corners.

Section V—Regulations For Welding

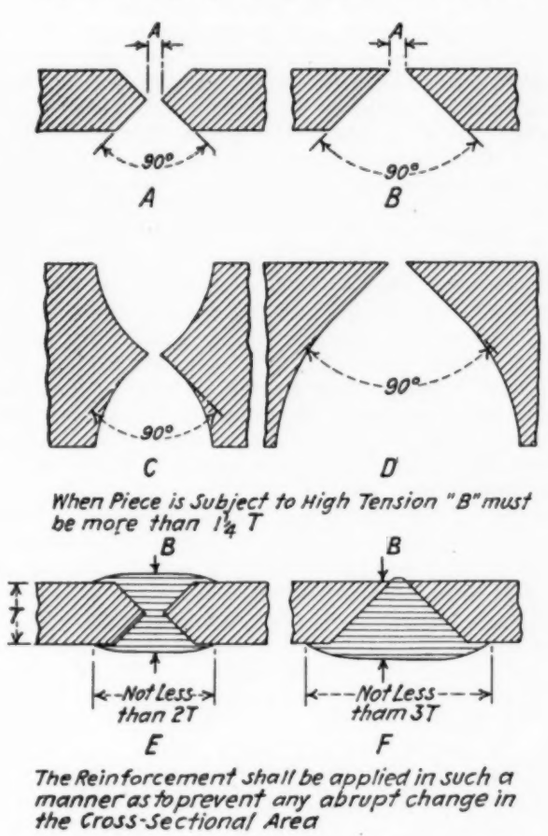
Paragraph (b)—Change the beginning of this paragraph to read: "The edges of the pieces to be welded should be prepared as shown on Figs. *A, C* or *B, D* of the drawing. The entire crack should be burned or chipped," etc. This change is made to permit preparation of large cross sectional areas in accordance with Figs. *C* and *D*, thereby reducing the amount of work necessary to prepare the section to be welded and also making it possible to weld fractures at such locations where it is impossible to provide the fractured ends with a straight sided Vee. The curvature extending from the straight part of the bottom Vee portion should be such as to permit free access of the welding torch or electrode.

Paragraph (c)—Changed to read: The portions of the part adjacent to the fracture should be heated prior to welding. In welding, the operator should begin to weld at the point farthest away from the outside edge and work towards the edge. All efforts must be made to reduce oxidation to a minimum. In gas welding the scale and oxide, coating the deposited filler metal should be removed from each layer before the new layer of welding metal is applied. For thermit or liquid steel welds, the spacing between the ends to be welded should be sufficient to permit free flow of the molten steel. The mold should be properly vented and gated to permit the escape of gases and the floating of impurities. The ends of the members to be welded shall be thoroughly preheated before the weld is made. Fluxes are not necessary for the gas or electric welding of wrought iron, wrought steel or cast steel entering into the construction of cars, locomotives and tenders. For the welding of cast iron and non-ferrous metals, the best results are obtained by using proper fluxes.

Paragraph (d)—Change 1½ times *T* to 1¼ times *T*.

Paragraph (e)—Add: Some of the steel castings are of such size that it is impossible to anneal the entire casting after welding. In such cases local annealing shall be done; the welded section to be brought up to annealing heat at a slow rate in order to prevent any abrupt change in structure.

Paragraph (g)—Change to read: On cars in interchange service, when truck side frames and bolsters are welded, the weld must, etc.



Drawing Showing the Manner in Which the Edges of the Pieces to Be Welded Were Prepared

Note: When equipment is not interchanged, it is optional to apply stenciling.

The report is signed by: J. T. Wallis (Chairman), Pennsylvania; H. T. Bentley, Chicago & North Western; A. M. McGill, Lehigh Valley; J. T. Carroll, Baltimore & Ohio; G. W. Rink, Central of New Jersey.

Discussion

O. S. Jackson (U. P.): Autogenous and electric welding stands out preeminently as the most revolutionary process in the category of railroad shop methods. Like all that is revolutionary, its blessings are not un-alloyed. In not a few instances its very convenience, coupled with ignorance of possible results, has led to excesses which proved a curse rather than a blessing in final results.

The report just presented is constructive in that it contains conclusions and recommendations based on careful research work in shop and laboratory.

In general, I desire to endorse the conclusions—there are, however, a few points that could possibly be clarified. Following the discussion of steel and steel tired wheels there appears to be an implied recommendation as to whether or not either gas or electric welding is a safe and desirable practice for this work. With reference to treatment of tires and forged steel wheels, our practice has been restricted by experience to building up flat spots by the electric process. Several driving tires have failed where the retaining lip had been burned off, contrary to standard practice, to facilitate the application of shims.

Fractures developed in each case from one of the myriad of minute expansion fissures or heat cracks always present on any torch cut or welded surface of high carbon steel.

To illustrate the danger arising from burning off this bead, and as typical of the serious condition in which the surface of high carbon steel is evidently left as the result of torch burning, we at one time had two cases where a complete set of new driving tires were applied to a switch engine, and on account of the tires not going in far enough to gage, the tire retaining ring shoulder or bead was burned off all tires with the ox-weld torch.

On one engine, two tires, about 18 hours after being placed, were found broken in two places. On applying the sledge hammer test, the other four tires broke. On the other engine, three tires in a set broke. The material in these tires met specifications.

A number of driving tire failures followed the introduction of the practice of welding a telltale spot on the tire and wheel center to detect loose tires, and the same phenomenon was present, a detail fracture beginning in a minute surface fissure. Restoring flanges of worn tires is a dangerous practice, as the extreme fibers are under highest stress, and the deposited metal is a poor material to withstand such stress.

Several years ago we had one or two cases of plate failures on rolled steel wheels, as a direct development of a local point using the cutting torch to burn the lathe driver holes, instead of drilling.

We have had driving axle failures directly due to merely welding in the small cupped cavities formed by eccentric set screws; also several cases of main axles failing on account of eccentrics being welded to axles to prevent slipping of the eccentric; also failures of main axles where the wheel fit has been built up by the electric welder and returned. We have had piston rods break where crosshead fit was built up by the welder, and returned.

A comparison of gas and electric welding indicates that gas welding is a better method for low carbon steel, as the conditions are represented by Plate "H," showing gas and electric welded firebox steel samples. The electric method is recommended in the report for welding boilers and fireboxes. This suggests an apparent inconsistency, which I have not been able to reconcile, and I presume this may have been noted by other members.

A statement is made in the report that under normal conditions any detrimental effect on the base material can be removed by subsequent annealing or sufficiently high pre-heating. I desire to take exception to this as a general statement, as the committee has possibly overlooked the physical phenomena of the myriad minute expansion fissures or heat cracks that develop in the surface of heat cut and welded steels, especially those having high carbon content. It has been our experience in examination of a large number of failed parts sent in to the laboratory for inspection and analysis, that many of these failures had their orgin in one or more of these minute heat cracks, which had gradually opened up into a failure. These heat cracks cannot be removed by annealing, although they may possibly be avoided to some extent by pre-heating. The only safe remedy lies in machining, where possible, the welded or heat cut surface slightly below the zone of damage. We have had so many concrete and conclusive examples of this form of failure the last year or so that we are becoming very skeptical as to the general use of the welder under ordinary shop supervision, and find it necessary gradually to prohibit the welding of or on certain locomotive parts subject to high stresses until we can learn more about the nature of the physical changes occurring in such parts, and whether the surface damage done to our steels by welding is a thing that can be overcome. Welding on alloy steels we believe to be very dangerous, and we prohibit welding on side and main rods and piston rods altogether.

Pre-heating of steel parts to be built up or welded is undoubtedly beneficial, but, unless careful supervision is exercised, you will find a tendency of shopmen to pre-heat with the oxy-torch instead of the furnace or oil torch on account of the ease and quickness of the former, but with disastrous results.

Welding cracks or fractures will be permitted on crossheads—except in neck and wrist pin hole, or any part of crosshead under similar stress. The rule as stated would seem practically to eliminate welding of crossheads altogether. The road with which I am connected finds it a safe practice to reduce the diameter of a worn crosshead pinhole by pre-heating and welding in by gas. Cracked crossheads are not reclaimed.

The rule in connection with crown sheets states that no welding in crown sheets shall be permitted, except that the crowns may be welded to the side sheets, flue sheet, door sheet or combustion chamber. It is presumed that reference is made solely to seams, and does not prohibit the practice of welding small cracks that open up from time to time between staybolts in crown sheets. This feature should be clarified, as I believe this to be a general practice, and not prohibited by Federal rules. The rule as stated will also work a considerable hardship on such roads as are operating U. S. R. A. power, which employs transverse welded seams between crown sheet and combustion chamber sheet, as it will be necessary in repairs to substitute a continuous crown and combustion chamber sheet. I believe a lap weld transverse seam for repairs safe and acceptable at this point.

The proposed rule on door sheets would not apparently permit the practice of welding patches into the flange or knuckle of the door sheet, in order to repair cracks in the flange or knuckle, unless the weld is carried at least 12 in. below the highest point of the crown, thus necessitating a much larger patch than usually is required.

The manner of welding patches on back head is specified, but the rule does not cover or advise whether or not the practice of welding in one-quarter or one-half back head sheets is permissible, and, if so, the method to be employed. The same remarks apply with reference to one-half or one-quarter outside side sheets. In view of the number of thersic syphons now being introduced, it is regretted that the committee has not developed a standard seam for the attachment of thersic syphon to crown sheet.

W. A. Ferrier (N. Y. C.): With reference to Plate K, showing method of preheating locomotive cylinders before welding, it has been found that in cases where cylinders are broken, as shown, it is possible to fill in with bronze, which requires no preheating and which has proved to be very satisfactory. Torch cutting should be restricted, even on the low carbon steels, to parts which can be annealed, preheated or the edges which have been burned, properly machined or chipped to remove internal stresses.

It has been our experience that welding or building up truck equalizers, except at the ends, should not be permitted. Building up locomotive frames promiscuously is liable to cause trouble and should be confined to places which are properly braced. We believe, to be properly protected, it is good policy to anneal spring or bolster hangers, even though they are of low carbon content. This would also apply to building up holes in levers.

Welding cracks or fractures in wheel centers and welding of wheel centers should be restricted to the spokes or rims of the wheels. The hubs of the wheels should not,

in any case, be welded, due to the heavy strain when pressing the wheels on the axles.

With reference to barrel sheets, would suggest that this read, "No welding permitted on unstayed surfaces." This would eliminate any possible chance of building up or filling in pit marks or other deteriorations of the sheets.

Regarding door sheets, unless there is some good reason we are not familiar with, we can see no necessity for maintaining a 12 in. minimum limit below the top of the crown sheet. Would also suggest that a mention be made that all welds, where possible, should be kept out of the fire line. Due to the expansion and contraction of the front flue sheet, no welding should be done at this place. The 12 in. minimum limit from the highest point of the crown sheet be removed when considering the back flue sheet.

In the paragraph referring to the back head I would suggest that this be changed to read, "Welding permitted if patch does not extend above the two rows of staybolts above the firedoor hole opening. On patches applied to the side sheets and back head, the bottom line of weld shall be located not lower than above the bottom row of staybolts or preferably the patch should extend to the bottom of the mud bar." Our reason for extending the patch to the bottom of the mud bar is due to the fact that it is practically impossible to weld a patch at the top and bottom without setting up strains in the sheet.

The paragraph on inside side sheets should read, "No restriction provided line of weld is kept out of the fire line and is at least one row of staybolts below the radial staybolts in the crown sheet. Promiscuous welding of patches on the side sheets should not be allowed. Two patches should be the limit for any one side sheet, exclusive of corner patches. Cutting torch on boilers, should be permitted, provided the edge of the sheet is redressed by chipping or other method before welding.

In regards to the methods of preparing sheets for welding, our experience has been that the dimension "A" should be not more than 1/16 in. for acetylene welding, due to the necessity for filling in by melting the sheet with the torch before building up with the welding rod. The diameter of a lead pencil would be satisfactory for electric welding.

G. E. Doke (N. Y. C.): With reference to the welding of cast steel truck side frames: Under the present Rule 23, section 4, A. R. A. Code of Rules, welding of cracks or fractures is permitted on cast steel truck sides. In conjunction with such welding the practice to be followed and the preparation of the frame to be welded is covered in some detail. Following the welding of such frames, the instructions read that certain stamping or identification must be applied near the weld.

The instructions are not being followed in many cases. Cast steel truck side frames are being welded with little or no regard as to the proper preparation of the material at the point at which the weld is to be made. Sections in tension members of frames are welded where it is apparent that the original fracture must have extended practically through this member. Welds are applied over material which is honeycombed with blow holes and porosity and in many cases the defective material is not cut away at all, the weld simply being applied to the exterior.

During the past 12 months, three welded cast steel truck sides have failed on our line, causing disastrous wrecks. In no case had the metal at the original point of fracture been cut away before making the weld and neither had the frames been annealed following welding, nor was there any stamping in evidence to indicate the railroad making the weld.

It appears that under the present ruling you cannot prohibit the movement through interchange of welded cast steel truck side frames if the identifying stamping is not in evidence, as the receiving car inspector does not know but that the weld was made prior to the ruling covering stamping. The failure of a cast steel truck side frame in the first place has indicated a weak point in the particular frame and this may extend over a considerable area.

The wide variation in tensile strength of welds made on such material certainly warrants the recommendation that all welding be prohibited on cast steel truck side frames.

W. O. Thompson (N. Y. C.): I would like to make a motion that the welding of cast steel truck side frames be eliminated from the permissible articles to be welded.

A. G. Pack (I. C. C.): Permit me to call attention to the fact that the welding referred to is not all done by railroad representatives while the cars are in service. There is a great deal of welding done by the manufacturers to cover up defects. That ought to be taken into consideration in connection with the motion that Mr. Thompson has made.

J. M. Hopkinson (D. & H.): There is a difference between a crack and a defect in side frames. If you are welding a crack you are welding a defect. They both ought to be included.

E. Wanamaker (C. R. I. & P.): I would like to call attention to the fact that while the Mechanical Division is in a measure a regulatory body it seems to me they also have another function to perform and that is the economic maintenance of the equipment under their jurisdiction which complicates any question which may arise with regard to standards.

Now, in case it is decided to repair a truck side, and providing that there is not too much porosity or other defective material, it is possible to make the weld and then reinforce the tension member. Our experience has demonstrated that we then had a truck side that was superior to the original truck side because the inherent weakness had been discovered and removed.

The Mechanical Division should, within the coming year, strive to present for many typical jobs at least one good way of making an autogenous weld. There may be others as good. There may be others better, but we should present one good way that it can be made, and insist that that method be used, or a better one.

Further it might be well not only to prescribe the method, but have a little something to recommend regarding the application of the process. Having been closely identified for some time with the electric autogenous welding processes and their application, I personally have long felt that we have not safeguarded the use of the process as we should. In other words, I do not feel that we should more or less blindly condemn certain methods of application of these processes, but that we should take the time and devote our energy to ascertaining how these processes may be safely, economically and intelligently applied.

W. H. Fetner (M. P.): I do not feel that this is a question that should be presented at this meeting and I move you that the original motion be amended to provide that the question of prohibiting welding of side frames be referred to letter ballot so as to develop a view of all the members of the association.

F. H. Hardin (N. Y. C.): I concur with Mr. Wanamaker that no hasty action should be taken on a subject of such great importance, but an analysis of the question which is now under discussion I think will reveal that no hasty action is being taken. In the first place we are all familiar with the methods now in effect for welding cast steel. I do not think that the N. Y. C. is an exception in having had failures of cast steel side frames through old welds.

If any action is taken by this association it is subject

to approval by letter ballot, as I understand it. It is further subject to approval by the General Committee and then by the Board of Directors of the association, so this convention cannot immediately put into effect any changes in the Interchange Rules. If no action is taken by this convention it practically means delaying any action on the subject for another 12 months.

We are receiving cast steel side frames which are not welded in accordance with the rules. It is the result either of gross ignorance or indifference, and I submit that the latter is next to criminal. It seems that there is no question of economy involved because the difference between the cost of replacing the frame and the $22,000 expense that Mr. Doke cited can't be compared.

There is another item in the danger of failure of one of these frames while passing another train, perhaps a passenger train. The present rules in our opinion cannot be so framed as to be enforced. It is difficult, almost impossible, for an interchange inspector to go over a cast steel side frame with such care as to locate these welds. Under the present rules he is forced to accept practically anything that is received, and apparently the only rule that you can enforce is to prohibit the welding of cast steel side frames in any manner.

In addition to the motion I would like to suggest that consideration be given to the removal from service of all frames that have been welded in the past.

Mr. Brazier: There are very few men that know how to weld properly. It takes quite an understanding to do a good job, and if we follow the formula laid down it will be all right, but we have not done so. We are not running any risk in prohibiting the welding of cast steel truck sides until we know what ground we are working on. I hope that this motion will prevail and go to letter ballot.

Mr. Doke: In answer to Mr. Wanamaker's argument on economy we have been experimenting with welding cast steel truck side frames for about seven years and during that time it has developed, that if we weld a cast steel truck side frame so that it is approximately as strong as a new frame, we can save approximately two dollars by scrapping the old frame and taking advantage of the scrap value and getting a new frame.

Mr. Lynn (P. & L. E.): I support Mr. Thompson's motion. I have always taken the position that we should do everything we can to conserve the frame. Some years ago our present president with several other of the roads in the eastern section of the country held a meeting in Philadelphia and after spending an entire day we agreed to welding and to permitting frame to run with cracks extending to a certain distance in the frame. I see where I made a mistake in fighting to save money. We have never attempted on the P. & L. E. to do any welding in our own shop. We have returned a number of our frames to the manufacturer, had the defects welded and the frames properly annealed and they were sent back to us but, going over our scrap piles and seeing the manner in which welding is being carried out all over the country, when our cars come home and we take the frames off I believe it is time for this association to adopt Mr. Thompson's motion and I would like to see this association take some action on this today.

C. G. Juneau (C. M. & St. P.): I cannot but concur in some of the remarks that have been made in regard to the welding of cast steel truck frames. The point made by Mr. Wanamaker in saying that after making the weld in the tension member that it should be supported with a wrought iron strap. I would like to ask a question to how he protects the frame, after the rivet has been driven, from cracking out from the hole through which the rivet is put. We find in many frames that have been so patched where we had as many as 24 rivets in the bottom member half of the number of rivet holes were cracked out thereby destroying the member. The trouble has been with the failure of the truck side and the welding of a poor quality of casting which we received in the early history of steel casting. Another thing that is causing a great deal of trouble is the improper facilities for handling the work on the railroads. We may have two or three shop points where we have annealing furnaces. There you can take care of it fairly well. What do you do when you get out in the mountainous territory, when you have got a loaded car? A man has got a welding torch and he proceeds to weld it and he does not even take it off of the car at times. It is impossible to supervise because we do not see it. What he has in mind is to keep the load moving. That is his instruction from the head of the road down to the boss in charge of the territory. I believe the motion should prevail and the matter placed before the railroads by letter ballot.

Mr. Hardin: It is not going to be so costly to the railroads in eliminating some of these frames as might be supposed. The failure in the welding is confined almost entirely to the older type frames, particularly the D section. Most of those frames have been in service long enough now to be eliminated anyway.

R. L. Kleine (Penna.): The import of what Mr. Hardin has said in regard to the welding of side frames ought to be taken into careful consideration. It is a pretty broad subject and I do not believe there is a unanimity of opinion on it. I do not think Mr. Hardin would object to welding the compression member of a frame. I think he refers altogether to the weld in the tension member of the frame, and the present rules do not permit the welding of a crack that is over 40 per cent., or about two-fifths of the section of the frame. Of course these frames that are failing are either the L or the D section, and as Mr. Hardin has referred to they are weak originally in the design. We do not have the failures with the U section type of frame, but I think the entire question should be referred to the welding committee to prepare a formal ballot on it and then submit it to the members for a ballot vote. I think it should be subdivided into a number of questions. The seriousness of the failure of a weld in a truck side frame and some of the poor welds that are run, requires your careful consideration.

Mr. Hardin: I certainly do not object to the welding of the compression member of itself but I submit that the man that is doing the character of welding that we have seen won't differentiate between the compression and the tension member. I further submit that if he is careless in his welding he may set up stresses in his tension member through welding the compression member. I have seen that done, particularly on bolsters. I have seen bolsters cracked in another spot entirely due to welding a crack. In the third place you are still going to put it up to the interchange inspector in a most difficult manner to determine whether there is a weld on a side frame on the car he is accepting that does not comply with some instruction which is laid down.

Mr. Brazier: Mr. Chairman, will you have the amendment read so that we can all understand it?

The Chairman: I will ask the mover of the amendment to repeat it.

Mr. Goodwin: I move you that the original motion be amended to provide that the question of prohibiting the welding of side frames be referred to letter ballot so as to develop the attitude of all of the members of the Association.

The Chairman: Will that amendment be acceptable to the maker of the original motion?

Mr. Thompson: I do not think the amendment is necessary. It will have to go to letter ballot anyway.

E. G. Cromwell (B. & O.): I am rather inclined to think that we should take this matter under very serious consideration. To say that we are carrying on methods that are fraught with the amount of risk that some of the speakers have mentioned today does not fit well on a body of men of the mechanical inclination that we have, and who are responsible for the destinies of our railroads. There is not anything that we do in connection with our work but which from time to time we have to modify and improve. If that was not so this body would not be assembled. If we knew enough when we started out on a proposition to make it perfect or nearly perfect, we would be transferred to another sphere. We would not be living here. I think and believe that it is necessary to strive for perfection. This question of the failure of cast steel side frames is probably due to numerous causes. I think with most of us it is a question of design. I do not believe you have any trouble with your more modern design. If you are going to work and establish a standard cast steel truck side frame in connection with your standard car, your cast steel truck side frame is going to be such an expensive thing to maintain, and if you are going to have it fail and throw it away, why did you put the cast steel side frame in your standard? I submit it is a question of design that led you to come to that conclusion. Every one believes and has confidence in the design of the cast steel truck side frame as presented by the Committee on Car Construction. Now to take the other step that the cast steel truck side frames are no good does not appear to be taking hold of the proposition along the right lines. We have had failures of arch bars under trucks and I believe you have had more of them than you have had in cast steel truck side frames. I believe that the committee should have a chance to revise and go over the instructions in the light of the discussion we have had here today, and I hope that the action of this body will be such that they will give them an opportunity to do so.

The Chairman: I believe it is one of the most serious questions that you have had to consider and to decide on at this convention. Further it should be understood that you are voting, that you have a standing committee on autogenous welding, one very capable of considering this subject and one that I am sure is qualified to give a solution to this problem, and it is my thought in view of the seriousness of this subject that the welding committee should prepare the ballot, however, if you insist on the amendment being placed as presented it will be necessary that I do so.

The Chairman: The amendment has been made that a ballot be prepared by the welding committee meeting the requirements of this question and in accordance with the rules of this association be presented to the railroads to be passed upon. All in favor of the amendment as it has been corrected will please rise?

Mr. Hardin: I rise to a point of order. The motion was originally made that the welding of truck side frames be prohibited. That would go to letter ballot if passed, would it not?

The Chairman: Necessarily.

Mr. Hardin: Then Mr. Goodwin made an amendment suggesting that the matter be submitted to letter ballot and then another amendment was made by Mr. Rink that the ballot be prepared by the Autogenous Welding Committee. Are you now voting on Mr. Rink's amendment?

The Chairman: We are voting on the amendment to the original motion as corrected and agreed to by the gentleman making the amendment to the original motion, and as I understand the matter it is order properly before the assembly.

Mr. Hardin: I understand that it is. I am in favor of the Autogenous Welding Committee drawing the ballot assuming that it is also subject to the approval of the General Committee, which I believe it is.

The Chairman: I will ask those in favor of the amendment to the original motion as corrected to again rise. Those opposed will please rise. (*The amendment was carried.*)

J. Snowden Bell: There is one detail of the welding operation as applied to locomotive boilers which the committee has not dealt with and that is one in which I happen to be personally interested and I should like to hear something about it. That is the connection of flexible staybolt sleeves to boiler sheets by welding instead of the old practice of screwing.

Mr. Purcell: We welded our sleeves for the past six or seven years and we have had very satisfactory results. We are continuing it and I was going to raise this question if Mr. Bell had not.

I looked those rules over several times and I do not just understand, and there are one or two points I want to call attention to by asking Mr. Rink if we are permitted to weld up the worn places in coupler shanks.

Mr. Rink: I would say yes, to that.

Mr. Purcell: We have made a very great many experiments in welding fire box sheets and all kinds of steel, and so forth, and we have come to the conclusion on our line that we are staying away from welding anything that requires a stress of 45 per cent. or up.

I think the most essential thing we always do is to have first-class welders and have a first-class man to supervise and see that the work is done in a first-class workmanship manner. We have a full and complete set of rules governing welding. The work is done from one part of the line to the other in the same manner. Good welds can be made and they are made. We have the practice of making all our welders weld test pieces. Those are sent to our laboratories and tested for strength. Where we find bad welds those are sent back to the men who weld them. We have regular schools of welding. We make periodical tests, and we bring a locomotive in and weld a patch in the fire box sheet and then decide to scrap the engine, and cut it out and take it over to the laboratory and test it.

Mr. Lynn: Within the last two weeks we had what might have been an awful accident just by an equalizer bar breaking off inside of the pedestal. The inspector no matter how careful he went over it could never detect a flaw. When I got the equalizer bar in my office I found that it had been built up by the welding of probably a half-inch or five-eighths inch of steel. Probably one-half of that equalizer bar, you could see by the strain that the metal had not hardened. The top part of the bar was o fibrous material and it broke, and the train was running at about 55 miles an hour.

A long part of the bar when it pulled out doubled up and you could not tell a thing. It would take an analysis to tell anything about that part of it, but the welding of equalizers or building up, unless you get a man that thoroughly understands his business as has been brought out here today, I am fearful that very few of us can get such a man, and I think we are practicing false economy when we will do that kind of work on passenger cars.

Mr. Rink: The welding of cracks on equalizer bars is not permitted. That item refers to building up of worn surfaces providing there is sufficient of the original material left.

The question raised by Mr. Jackson with reference to the welding of steel in steel tire wheels as to the report

not reflecting which was the better method: The party conducting those tests informs me that there was practically no preference as to which one was acceptable, but the report of the committee eliminates both types of welding as covered in one of the paragraphs.

There is also a question raised about the welding of fire boxes. While welding seams by the acetylene method seems to give a higher tensile strength in the weld it appears that there is a greater amount of expansion and for that reason the electric weld method seems to be preferred.

There was also a question raised about why the limitations were set in the welding of the back sheets such as the door sheets, limiting same to a point no higher than 12 in. below the ground. That was based on the assumption that that portion of the sheet generally stays in pretty fair condition where the lower portion is the portion that generally gives trouble, and when it is necessary to go over that it is just as well to put in an entirely new back head.

Mr. Purcell: May I ask Mr. Rink if he refers to the back head or door sheet

Mr. Rink: The back head.

The Chairman: The point brought out by our representative regarding equalizers is a very serious one. He spoke of one instance. I know of four others that broke off because the equalizer had been built up by electric welding, and in the corner under the neck of the equalizer there was concealed from vision a flaw. In service that end of the bar broke off and the trains were running at a very high speed. The suggestion deserves serious consideration along with the side frames.

Mr. Pack: We have in the United States 70,670 locomotives engaged in interstate commerce. They run over 165,000 miles of railroads and repairs are made by all kinds of men, and many sharp practices are used to avoid making the proper repairs, and when this Association goes on record as making a standard practice of anything that may be questionably used, I think it should be done with very extreme care.

I am extremely interested in safety, but in considering safety I have always tried to take into consideration the cost of these things. The cheapest is *not* always the best.

Mr. Chambers: I doubt if you will lay down any fast and hard rule that all roads will comply with when it comes to electric welding and the extent of it. It will be like many recommended practices for standards. The individual road for its own purposes must finally decide on whether a thing is good, or not, for it. Surely no one is concerned more than the individual road about what may happen from electric welding or other types of welding, autogenous welding, because they not only have to stand the expense but the embarrassment if it is a failure.

I move you that the report be accepted and that the different items brought to the attention of the committee by the members or that they may submit to them in writing later be given consideration, and that a letter ballot be prepared by the committee for placing it before the members.

The motion was seconded and carried.

Report of Resolutions Committee

WHEREAS, The Railway Supply Manufacturers' Association have this year exceeded in exhibits formerly made so successfully and interestingly explained to all officers by the individual firm's representatives and have so generously arranged for the entertainment of members and families of Mechanical Division;

WHEREAS, The Atlantic City Hotel Men's Association have as usual so comfortably provided for our sojourn while in this City;

WHEREAS, The Mayor of Atlantic City has continued to make this a City so much to be respected and inviting to our Convention;

WHEREAS, The Management of Young's Million Dollar Pier has maintained and improved conditions for our comfort in holding our meetings and visiting exhibits;

WHEREAS, *The Railway Age* has in such a prompt and fitting manner printed all of the paper reports and edited the daily arrivals which has year by year become more to the Convention members and visitors than any periodical or newspaper;

WHEREAS, We do appreciate to the fullest extent the attendance and addresses given to the Convention by Messrs. R. H. Aishton, L. W. Baldwin, W. H. Winterrowd, J. G. Blunt, G. T. Ripley, F. H. Shephard, Frank McMannamy, W. R. Cole and W. R. Scott.

WHEREAS, The Committees have so fully compiled their reports and presented them in such a forceful and interesting manner to the Convention;

WHEREAS, The Car Construction Committee has practically completed its arduous task after so many years of untiring work;

WHEREAS, The Committee on Brakes and Brake Equipment for the past two years have given the Association such wonderful support and untiring effort in the extended hearings on Power Brakes and Appliances before the Interstate Commerce Commission;

WHEREAS, The Pennsylvania Railroad, Reading Railroad and Jersey Central Railroad have so liberally provided transportation to the members and their families to enable them to reach Atlantic City;

WHEREAS, The Executives of the American Railway Association have so inspired the Mechanical Division in its work to make conditions on American railways better for business and the traveling public in general;

WHEREAS, The meetings of the present convention have been so ably planned and guided by the Officers and Secretary and his staff;

Be It Resolved, That the appreciation of the members of the Mechanical Division be extended to all the aforesaid mentioned for individually and collectively making it possible for the largest and most interesting convention before assembled.

Report on Brakes and Brake Equipment

During the past year Purdue University has conducted some brake shoe tests for your committee. The committee was not present or represented at these tests and the information will, therefore, be used in a further study of the brake shoe situation as a whole. It is interesting to note, however, that some of the shoes tested developed a much higher co-efficient of friction than is contemplated in the present specifications which provide only for a minimum mean co-efficient of friction and would, therefore, raise the question as to whether or not both the minimum and maximum should be provided for in our specifications. This is

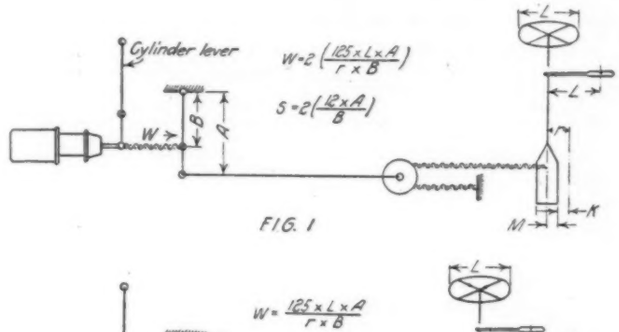


FIG. 1

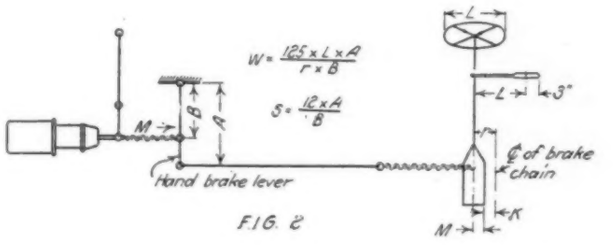


FIG. 2

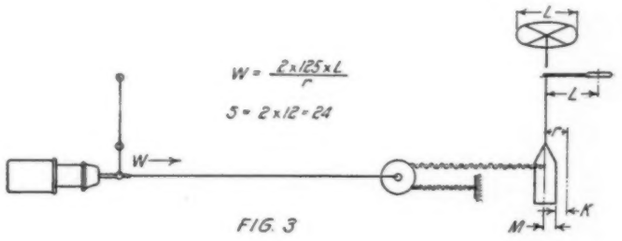


FIG. 3

a subject to which your committee is now giving consideration.

Your committee has also been requested by brake shoe manufacturers to make some additional tests of their types of brake shoes. This is also being considered in conjunction with tests which have already been made.

Failure of Brake Beam Hangers

Your committee has been requested to give some consideration to the question of brake beam safety supports. While it is realized that this is an important subject the committee has been unable to arrive at definite conclusions to formulate any proper recommendations, but believes that more consideration should be given to the method of attaching beams to trucks and details of hangers and supports rather than providing safety supports. Your committee has in mind a change in brake heads to prevent wear of hangers which in many cases cause failure, which should eliminate the liability of failure from this source.

Twelve-inch Air Brake Equipment

Consideration has been given to a 12-in. air brake equipment for six-wheel truck freight cars. A satisfactory equipment of this kind has not so far been developed and the matter is still under consideration.

A number of other subjects have been considered during the year, but no definite conclusions were reached and these subjects have been continued on the docket for further consideration during the coming year.

Recommendations for Letter Ballot

Your committee recommends for letter ballot to the members this year the following:

Hand Brakes.—New freight cars or cars rebuilt after January 1, 1925, shall have the hand brake arrangement as follows with respect to the braking power: Based on the formulæ and dia-

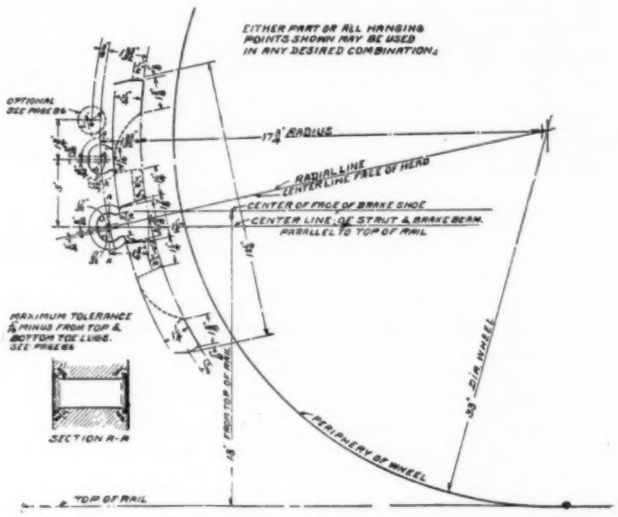


Fig. 4

grams shown herein, the hand brake wheel or hand brake ratchet lever, brake staff at chain, and the hand brake leverage between brake staff and cylinder, shall be so proportioned that a force of 125 lb. at the rim of the brake wheel or three inches from outer end of hand brake ratchet lever will develop an equivalent load *W* at the brake cylinder piston of not less than 2,500 lb. and 3,950 lb. respectively for cars having 8-in. and 10-in. cylinders.

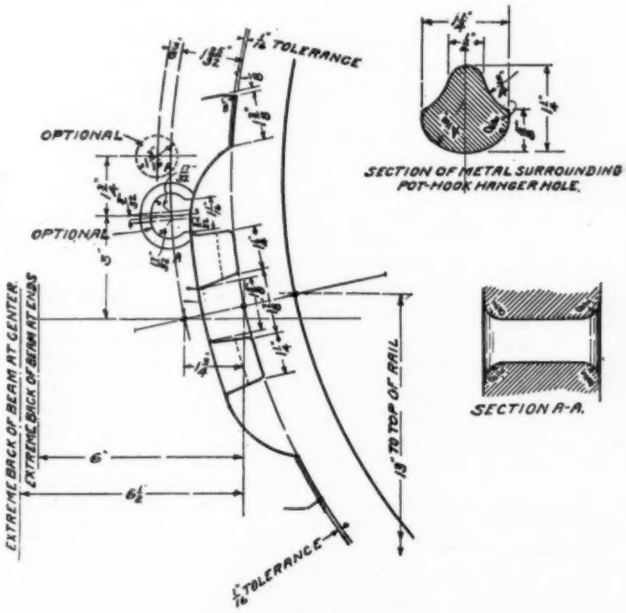


Fig. 5

Letters used in Figs. 1, 2 and 3 have the following significance:

W = Equivalent pull in lb. at brake cylinder piston rod.
125 = Assumed lb. pull on rim of brake wheel, or on hand brake lever 3 in. from outer end.
L, r, A, & B=Dimensions in inches.
r = M + K.
M = Radius in inches, of brake staff drum.
K = Distance, in inches, from face of brake staff drum to center line of brake chain. For 7/16-in. brake chain. K = ½ in.
S = Minimum chain slack, in inches, to be taken up on brake staff.
12 = Piston travel in inches.
Note:—Dimension B not to be less 11 in.

Brake Heads.—Substitute drawings shown in Figs. 4 and 5 for those now shown on pages 84 and 86 of Section E of the A. R. A. Manual entitled "Procedure for Laying Out Drawing for Brake Head" and "Vertical Contour Limits for Brake Heads." These drawings do not change any of the dimensions now shown in the manual except that a fillet is provided in the hanger opening or groove to prevent wear of brake hangers.

This report is signed by G. H. Wood (chairman), general air brake instructor, Atchison, Topeka & Santa Fe; T. L. Burton, air brake engineer, New York Central; L. P. Streeter, air brake engineer, Illinois Central; B. P. Flory, superintendent of motive power, New York, Ontario & Western; W. H. Clegg, chief inspector, air brake and car heating equipment, Canadian National; Mark Purcell, general air brake inspector, Northern Pacific; R. B. Rasbridge, superintendent car department, Philadelphia & Reading; and J. M. Henry, general superintendent motive power, Eastern Region, Pennsylvania System.

Discussion

W. F. Peck (B. & O.): In the test of freight brake shoes, it is just as important in my opinion to establish the maximum mean coefficient of friction as the minimum. The retardation of the vehicle in feet per second is directly proportional to the mean coefficient of friction, and an increase of 100 per cent would have the same effect as increasing the braking power from 60 to 120 per cent. The formulæ pertaining to hand brake power I have checked against a series of tests conducted with dynamometers in 1920. As regards ratchet levers, the average results varied less than 5 per cent from the theoretical calculations offered in this report. Where brake wheels were used without a club, the results were approximately 15 per cent less than those obtained theoretically. It is possible to secure an improved body angularity when using the ratchet lever.

I must qualify these statements, however, by adding that the dynamometer travel permitted only a very short take-up of chain on the drum, so that the value of the factor r in the formulæ did not change. This detriment is offset when it is borne in mind that the use of the brake club is universal. Using a 28-in. club in the tests mentioned, it was possible to increase the tension exerted on the hand brake pull rod about 50 per cent. This excess of power is sufficient to compensate for any loss experienced due to the chain pyramiding on the drum.

The provision for a ⅜-in. fillet in the hanger opening of the brake head is highly commendable, since a very large proportion of hanger failures occur at the inside corners, where proper inspection is difficult.

G. H. Wood (A. T. & S. F.): Under the proposed change in the plan of brake heads you will note that we show a ⅜-in. fillet at the top and bottom. The committee has, however, gone into this matter with the manufacturers of brake heads and they point out that in order to provide the fillet at the bottom it will necessitate redesigning the brake head or weakening that point, so the drawing will be changed to show a very slight fillet at the bottom.

A motion was made, seconded and carried that the report be received and referred to letter ballot.

Report of Committee on Wheels

The most important work of this committee, as outlined in its 1923 report, was the revision of specifications for chilled iron and wrought steel wheels and the development of a new gage for steel wheels. The present report dwells on the progress made in the application of these specifications which were in some respects revolutionary, particularly as regards chemical composition. That the new steel wheel gage is giving generally satisfactory service is borne out by the report, which also comments on the difficulty of educating all the car inspectors and wheel shop men to understand fully its functions and merits.

One of the outstanding developments in the design of cast iron wheels is shown by this year's report to be the single plate wheel with A. R. A. type reinforcing rings. While apparently possessing important features of merit, this wheel is as yet not beyond the experimental stage.

The committee is to be commended for the work already done in preparation of a manual on wheel practice which it hopes to present for approval next year. This manual should prove effective in giving all engaged in handling wheels a ready means of determining the most economical and satisfactory methods.

In its 1923 report the Committee on Wheels called attention to the fact that a number of private car lines, as well as railroad companies, were still applying the old type light weight wheels and that this was not the proper practice, inasmuch as these wheels were not suitable for mountain grade service. They recommended an Interchange Rule prohibiting the use of these light weight wheels after a certain date. As a result the following rule was inserted in the 1923 Code of Rules:

The application of cast iron wheels cast after June 30, 1924, of nominal weight less than 650, 700 and 750 lb., shall be considered as improper repairs.

It now appears from reports received that some car owners do not plan to live up to the spirit of this rule. The owner of a car may apply light weight wheels and not be subject to any penalty. A large number of these light weight wheels are still being purchased and it is the fear of the committee that this practice will continue unless some further check is placed on it through the Code of Rules. We would, therefore, recommend that the following paragraph be added to Rule 3-N:

Cars will not be accepted in interchange which have cast iron wheels cast after January 1, 1925, of nominal weight of less than 650, 700, and 750 lb.

The old rule takes care of the application of wheels to foreign cars, but does not cover the case of owner repairing his own cars.

Marking of A. R. A. on Cast Iron Wheels

The question has been raised as to the wheels on which it is permissible to mark the letters A. R. A. The committee feels that it is a necessity for the railroads to be protected against under-weight wheels, wheels of inferior design, and wheels of inferior workmanship. They feel that the standards of the Association, both as regards design and specification requirements, are a minimum for safe operation. Under such circumstances, the only safe procedure is to limit the use of this marking A. R. A. to wheels which meet these minimum requirements.

It should be understood that there are no objections to putting the letters A. R. A. on wheels with extra weight, such as some roads use, due to reinforced flanges, or slightly different tread

designs, or wheels made to specifications with some extra requirements beyond those included in present standard specifications.

For this reason, the committee recommends that the Arbitration Committee give consideration to the inclusion of a rule, which will require the letters A. R. A. to be cast on all wheels, cast after a certain date, which are used in interchange, with the understanding that the letters A. R. A. shall not be cast on any wheels, which do not meet the minimum requirements, as to weight and specifications as referred to above. A suggested method of taking care of this requirement would be to add under Rule 3-N the following note:

The letters A. R. A. should not be put on any wheel which is of lesser weight than the standards of the A. R. A. or which is made to any specifications with requirements less than those prescribed in the A. R. A. specifications for cast iron wheels.

Marking on Rolled Steel Wheels

The new specifications for rolled steel wheels, adopted in 1923, contain the following paragraph regarding branding:

"(a) The date (day, month and year), brand of manufacturer, manufacturer's serial number and heat number and carbon contest designation shall be legibly stamped on the back face of the rim, approximately ¼ in. from the inner edge of the rim, as shown on Sheet 49, Section D, A. R. A. Manual. The height of characters shall not be less than 5/16 in. for hot stamping or ½ in. for cold stamping.

(b) The tape size shall be plainly stencilled on the back of the plate in figures at least 1 in. high.

It should be noted that this does not call for the marking of

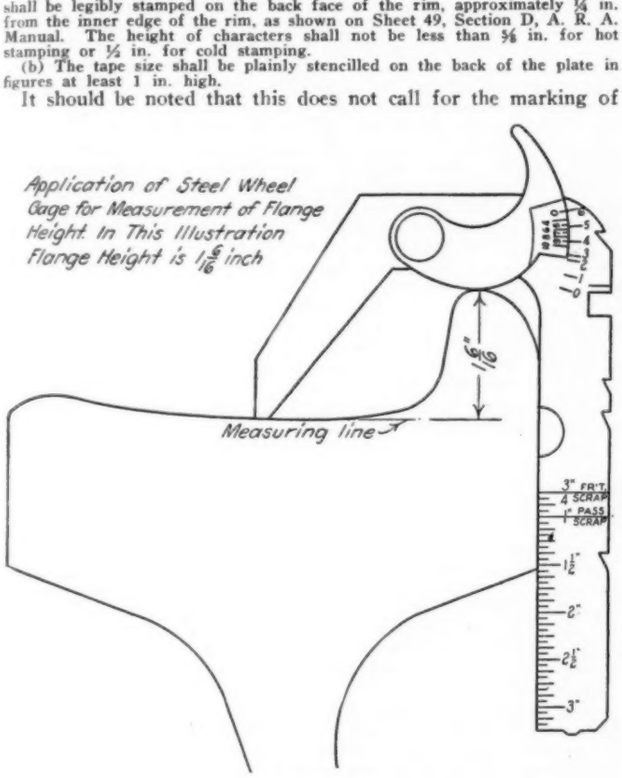


Diagram No. 1

either the serial number or name of railroad company. During the past year, manufacturers and users of rolled steel wheels have called attention to the confusion which exists regarding the proper marking of rolled steel wheels. The more figures and letters which are placed on the wheel the greater will be the confusion in reporting. As an example, this marking was found on one rolled steel wheel which was changed out on January 3, 1923:

"W1762-81917-80151G-A476022-A32763."

It is manifestly impossible for the inspector to be expected to report all of these numbers correctly or to know which number to report. It must be remembered that ordinarily the wheels are covered with grease; that part of the numbers are cold stamped and others hot stamped, and many are difficult to read.

The committee cannot see any necessity for the continuance of the practice of stamping the serial number of the individual railroad on the wheels. The serial number of the manufacturer, together with the date and brand of the manufacturer furnishes the necessary identification and additional numbers merely add confusion. Furthermore, the cost of cold stamping, which is the necessary practice for stamping railroad serial numbers, is a costly one and the committee feels that it is an unnecessary expense. There is also no need for stamping the day of manufacture. The committee, therefore, recommends that this latter requirement be eliminated from the specifications.

The question of the stamping of the name or trade mark of the railroad on each wheel is open to debate. Most railroads are apparently following the specifications and eliminating this marking. However, there are some roads who feel that such a marking is necessary to give them a record of the ownership of wheels which fail on their line. It would, of course, be possible to trace these back through the manufacturer's number, but this is a long process and it is felt that a more direct system is desirable. The committee does not wish to prohibit such stamping and believes that it should be left to the individual carrier. They would suggest, however, that the marking be made as simple as possible, showing the trade mark or letter combination instead of a full set of initials.

Change in Steel Wheel Specifications

Sub-Section 7-P, Depression of Hub, has the following requirement:

In connection with wheels to be used with journal boxes bearing on the front face of hub, such as car and tender wheels, the depression of hub below front face of rim shall not be less, but may be as much as 1/16 in. more than that specified.

This clause in the specifications has resulted in considerable controversy between inspectors and manufacturers, due to the fact that it makes no allowance for variation in the rim width of 1/16 in. over or under which is permitted by the specifications. The hub depression should be determined properly from the face of the flange. In some cases this condition is being met by the use of a special gage which applies to the back face of the wheel rim with a graduated rod extending through the bore of the hub.

The committee feels that this situation should be straightened out and therefore suggests that the paragraph in question should be changed to read as follows:

In connection with wheels to be used with journal boxes bearing on front face of hub, such as car and tender wheels, the depression of hub below front face of rim shall not be less, but may as much as 1/16 in. more, than that specified, based on 5½ in. rim width.

Results with New Cast Iron Wheel Specifications

Your committee has kept in touch with the progress made in the application of the new cast iron wheel specifications adopted last year. These specifications contain some rather revolutionary features, particularly, as regards chemical composition. It was thought at first by some of the manufacturers that they would be difficult to meet. However, the Association of Wheel Manufacturers decided to co-operate in securing their adoption and from reports received the railroads are gradually going to their use either in exact form or with slight modification as to wording, and in some cases with extra requirements. The majority of the manufacturers are apparently able to meet the specifications, though some foundries have found it necessary to make changes as to materials and equipment. This latter development is, of course, very desirable, as better wheels will be the result. It is too early to make an analysis of the results secured in service by wheels made under the new specifications, but we have some indication of what may be expected by referring to the thermal and drop tests made by railroad inspectors at the foundries. In order to amplify this information, some railroads have had their inspectors carry the thermal tests and drop tests to destruction wherever possible, rather than stopping at the specification limits. This procedure has developed some interesting information, and shows that in certain foundries the wheels will stand for much longer periods of time in thermal tests, than wheels produced by other foundries, though both types meet specifications. The difference in results of these tests indicate the value of proper annealing and the cleanliness of iron in the plates. The committee will continue to watch the performance of the new specification wheels.

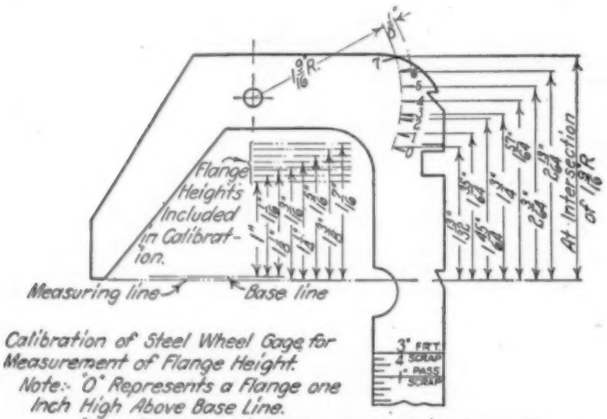
Cooling of Rolled Steel Wheels

Specifications for rolled steel wheels, adopted last year, do not contain any provision regulating the methods of cooling as used by the manufacturers. While the committee realizes that the method of cooling is an important factor in the strength of the wheel, it did not feel that the subject could be covered by specifications, as it was a detail which should be left to the manufacturer. This subject has been given a great deal of thought by the various manufacturers for many years, but apparently they have not arrived at any uniform method of handling this work. The committee members, in their visits to wheel manufacturing shops, have watched these different practices and it is their feeling that some of the methods which are being used could be improved. The strength of rolled steel wheels is an important matter, particularly because of their use under locomotives and passenger cars and every precaution should be taken

in manufacturing to avoid breakage in service. The committee plans to make hardness tests and microscopic examinations of sections cut from wheels, which have been put through various cooling processes, and endeavor to determine which process gives the better condition. During the coming year, they will take this matter up in joint session with manufacturers of rolled steel wheels, in an effort to arrive at some uniform practice which will be considered the most satisfactory. It is possible, as a result of this study, that some clause can be worked up to add to the specifications, which will prescribe certain qualities in the finished wheel, which will necessitate the use of the best cooling methods.

Specifications for Cast Steel Wheels

Suggestion has been made that the Wheel Committee prepare specifications for cast steel wheels, due to the fact that a large number of these wheels are now in service and passing over other roads than those which purchased them. It was felt that some protection should be afforded roads operating cars with these wheels under them, by the use of a standard specification. However, there is only the one manufacturer who makes this particular type of wheel and it involves certain patented processes. Under these circumstances the committee does not feel that the present time is right for the issuance of any standard specification. It is possible that in the future other manufacturers may develop a cast steel wheel, and if this occurs, it will probably be necessary for the Association to have a standard specification for the



Calibration of Steel Wheel Gage for Measurement of Flange Height. Note: "0" Represents a Flange one Inch High Above Base Line. "1" and "2" are Also in Reference to Base Line as They are Used For Gaging Flange Height of New Wheels Only. The Remainder of the Calibrations are in Reference to Measuring Line as They are Used in Connection With Flange Heights of Worn Wheels.

Diagram No. 2

protection of purchasers. The committee has, in co-operation with the manufacturer, worked up a tentative specification, and if any purchaers of cast steel wheels desire the assistance of the committee, it will be glad to assist them in the preparation of a specification for their individual use.

Developments in Cast Iron Wheel Design

During the past year manufacturers of cast iron wheels have continued their intensive study of foundry practice and wheel design, in an effort to improve the quality of their product. New types of cupolas have been put into service and the results look promising.

The outstanding development in new designs is the single plate wheel and the A. R. A. type with reinforcing rings. The single plate wheel, particularly in the heavy weights, has shown up well in experimental thermal tests and gives considerable promise of successful development, though it is, of course, entirely in the experimental stage at present. The development of reinforcing rings, referred to above, is the result of attempts made to overcome the difficulties due to collecting of dirt in the plate. The old M. C. B. type had a projection point at the intersection of the plates, which tended to skim off the dirt from the molten iron as it flowed out through the mold, and it was found that this produced a weak point in the plate. The change to the arch-type wheel overcame this difficulty, as this projecting point was eliminated. However, the total amount of dirt in the plate was the same, though it was scattered rather than concentrated. Wheels which break through the plate in service will frequently have dirt collections at the point of breakage. If new wheels have the front plate machined off, it will be found that there is a considerable amount of dirt, which undoubtedly is weakening. To overcome this, one of the wheel manufacturers developed a design which includes three raised rings on the outside plate. These rings serve as skimmers and tend to collect the dirt and slag. The main plate is thus of clean iron. Experimental thermal tests of these wheels indicate that these rings serve the purpose and strengthen the wheel, as they apparently stand a more severe thermal test than do the standard design wheels. Furthermore, when broken up, these reinforcing rings are usually found to be of a dirty metal. One railroad has arranged to put 1,000 of these wheels in service to demonstrate what results can be secured and thus assist the manufacturers in proving the possibilities of this design.

Wheel Mounting Gage

The wheel mounting gage shown on page B-42 of the Manual of Standards and Recommended Practice and the description given on page D-55 has been subject to considerable criticism. When wheels are worn in the tread, there are cases where point A and E will both strike the flange before C will touch the tread. It is thus impossible to follow recommendations which require A to strike the flange and C the tread. In such cases it is necessary to disregard the recommended practice so far as having point C touch the tread.

This mounting gage was primarily designed for cast iron wheels and when it is used on steel wheels certain conditions are found to exist which makes it unsatisfactory. In case two sharp flanged wheels are mounted together the gage results in improper mounting. That is, when the wheels are turned they will be found to be spaced too wide. This practice of mounting two sharp flanged steel wheels is common practice on many roads, as they dismount sharp flange wheels to re-mate, in order to save metal on mate wheel.

The opinion of the commmittee as to the proper way to mount rolled steel wheels is to use a spreader gage, such as is used in mounting locomotive tires. This gage should be 53⅓ in. in length. The committee does not recommend that this gage be made a standard of the Association, but suggests that individual railroads equip themselves with this type of gage for checking the mounting of rolled steel wheels, as it is their belief that the results will thus be made more satisfactory.

Standard Steel Wheel Gage

The standard steel wheel gage, which was adopted by the Association in 1923 is gradually coming into general use and there are at present many thousands in service. Generally speaking, the gage is giving satisfactory service, though of course it is difficult to educate all the various inspectors and wheel shopmen to a full understanding of the functioning and merits of this gage. The Wheel Committee has endeavored to render every help possible to representatives of various railroads who have brought questions to them as to the application of the gage. The use of this definite method of measuring service metal in steel wheels has undoubtedly been of great benefit. The old methods of making out bills for service metal in steel wheels were practically little better than guess work and the bills ran into such large amounts of money that there was undoubtedly much injustice in connection with this billing, though unintentional. This guess work system was easier for the men on the track than to use a definite gage, but the magnitude of the bills involved made it necessary that some better practice be developed. No new gages have been presented to the committee during the past year for approval. They will, however, be glad to consider any gage and approve any that meet the requirements.

Some railroads have raised the point that the new steel wheel gage has certain features which are not necessary for use in the car yards by inspectors and have suggested that a cheaper gage be designed to answer the requirements of inspectors. This applies only to roads who prefer to follow the practice of billing at the wheel shop. The original idea was that billings would be made at the time the wheels were removed from car, by direct application of the gage. This practice, which seems to be the most generally favored, requires that the inspectors have a complete type gage. However, if a railroad prefers to follow the practice of billing at the wheel shop, the committee suggests that the steel wheel gage be purchased without the moving finger. The cost would be less and will answer the requirements of an inspector, when used in conjunction with regular wheel defect gage. It appears desirable for inspectors to have some form of gage for measuring rim thickness in order that they may know when to remove wheels from under cars, when worn below limits. It should be remembered, however, if the movable fingers are left off the gages, for use by inspectors, it will destroy their

usefulness in the measurement of high flanges, which is proposed in this report.

Tread Worn Hollow Wheels

Rule 76 provides for the use of the standard tread worn hollow gage to gage tread worn hollow wheels, but no statement is made as to whether steel wheels as well as cast iron wheels are included. In the case of passenger car wheels, Rule 7 (4) states that the limit for cast iron wheels is ⅛ in., but no gage is provided; nor is there any rule for tread worn hollow steel wheels.

Your committee feels that the cast iron wheels in freight service are properly covered by this rule, but that some more definite provision should be made for steel wheels both in freight and passenger service. It is doubtful whether the gage is entirely satisfactory for the measurement of tread worn hollow steel wheels, due to the fact that in such wheels the outside edge of the rim wears down to a certain extent and the use of this tread

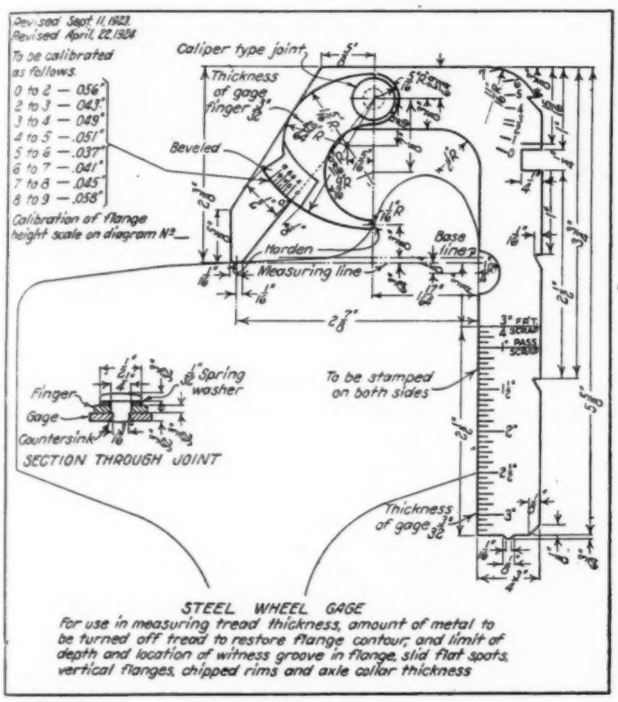


Diagram No. 3

worn hollow gage might continue wheels in service when the flange was too high. The basis of the wheel worn hollow gage for measuring tread worn hollow wheels is in reality flange height, which is, in this case, set at a limit of 1 1/16 in. It appears that a rule might be worked out for steel wheels, which would be based on flange height. Many roads now have flange height limits prescribed in their rules, but most of them have no gage for taking the measurement of the height of flange. The standard steel wheel gage, adopted in 1923, can be used for this purpose by adding an extra calibration on the leg, as shown in Diagram 1. Any road which desires to do so can have this calibration stamped on their gages. The dimensions for the calibration are shown in Diagram 2. It should be noticed that the measurement for the 1 in., 1 1/16 in. and 1⅛ in. flange heights are taken from the base line, whereas the remainder of the calibration is measured from the center of the tread or measuring line. This is due to the fact that the first three flange heights mentioned are used only by inspectors at the manufacturing plants in checking new wheels, whereas the remainder are used for worn wheels, in which case it is desired to know the height of flange based on the lowest point in the tread. To measure flange height the gage is applied, as shown in the diagram, with the moving finger swung through an arc of 180 deg., so that its back will rest on the top of the flange. The reading of the 0 mark of the movable finger on the calibration indicates the flange height.

Your committee does not wish to make definite recommendation at this time as to change in the rules to cover this question of tread worn hollow steel wheels. They would, however, like to have a discussion from the members on this question and recommend that the Arbitration Committee give the question consideration during the coming year.

Charges and Credits for Service Metal on Slid Flat Steel Wheels

The Arbitration Committee has referred to the Wheel Committee the question of simplifying the billing for service metal in rolled steel wheels in case of sliding flat.

Under present rules, the delivering line is responsible for the metal which it is necessary to turn off the wheel to remove the slid flat condition plus 1/16 in. and the owning line is billed for the remaining amount necessary to turn off the tread to restore full flange contour. This results in a complicated billing and the question has been raised if this condition should not be handled in the same way as in the case of axles, that is, the billing be made only on the basis of removal of metal to eliminate the flat spots.

The Wheel Committee believes there is justice in this contention of the Arbitration Committee, that the extra accounting for metal removed to restore flange contour is not warranted. As a general thing, in actual practice, it is not necessary to turn off much extra metal, because of restoration of flange contour. Furthermore, the rules allow only 1/16 in. extra metal because of the necessity of going under the hard surface metal at the flat spot. Observation in wheel shops indicates that this is a rather small allowance and it is frequently necessary to go under the surface more than 1/16 in. Under these circumstances, it appears that it would be just to eliminate the billing for the excess metal, to restore flange contour and bill on the basis of slid flat. On the other hand it would perhaps be an injustice to add to the charge carried by the delivering line in the case of slid flat wheels because there are some cases of slid flat wheels which are not in strict equity chargeable to the operating line, such, for example, as when there are defects in the brakes or rigging, or when wheels are out of round, due either to eccentricity in casting or eccentricity in mounting.

Tread Contour of Cast Iron and Steel Wheels

In the 1923 Report, the committee stated that it would make further investigation of the taper on tread of cast iron and steel wheels and give special consideration to the possibility of using straight taper instead of double taper. It appears that both the New York Central and the Baltimore & Ohio have adopted the straight taper type of tread on all cast iron wheels. The B. & O. has a straight taper on its steel wheels, and the N. Y. C. has adopted a modified double taper; the length of the second taper being reduced to 1 in. The N. Y. C. uses 1 in 38 and the B. & O. 1 in 13 taper, instead of 1 in 20, which is standard for A. R. A. The theory on which the N. Y. C. changed their taper was that they wished to improve the relations between the wheel tread and rail, with reference to area of contact. The B. & O. change was designed to increase the life of wheels by reducing flange wear. The committee feels that there is not sufficient data available to prove just what advantages may be expected from these changes. From a theoretical viewpoint, it appears that a straight taper is the correct design, but before recommending any such change there should be definite test data available. It is planned to run a series of tests during the coming year, which will indicate the relative wheel life with the various tread designs and it is hoped that the committee can report on this subject next year. In this connection we may call attention to the practice, which is now being followed to a considerable extent, of eliminating the sand rim on cast iron wheels, that is, the chiller is so designed as to chill the entire tread of the wheel. The practice also gives promise of giving better wheel life, due to cutting down the number of chipped rim failures. This development will be followed during the coming year.

Use of Large Bore Cast Iron Wheels

In connection with an arbitration case, involving a billing for cast iron wheels as scrap, which had bores greater than the limit for axle wheel seat, shown in the Rules of Interchange, the Wheel Committee was requested to render an opinion as to the advisability of the practice of using the larger bore wheels. The answer to this inquiry was that it was not only good practice to use such wheels, but that the rules should be so worded as to permit the practice. The results secured in tests made at the University of Illinois of cast iron wheels indicated definitely that it was a perfectly safe practice to bore out wheels larger than the limits set in the A. R. A. Rules. We, therefore, recommended that a tolerance of ⅛ in. above the standard limit be provided.

When new cars are purchased or when new wheels are mounted on new axles the wheels are always bored out to full limit, in order to conserve axle wheel seat stock. If for any such reason as cut journals, or other axle defects, the wheels must be dismounted, under the present rules these wheels are practically scrap, as it is ordinarily necessary to take a skin

cut out of the bore in order to get the proper fit. It has been the practice of many roads to make use of such wheels by mounting them on axles which are purchased with a slight amount of extra stock at the wheel seat. The committee feels that it is economically unsound to scrape these cast iron wheels simply because the bore is slightly over the limit which, as above stated, is the normal bore for the first mounting. This may give some difficulty in connection with billing, but the large amount of money involved in the value of such wheels makes it necessary. There is nothing definitely stated in the rules which fully governs the classing of any wheel as scrap because of its bore size, but the interpretation which has been placed on axle limit rules is that they also govern the wheel. On the other hand, there are established gages for determining when cast iron wheels shall be remounted, these applying to the tread only, and the implication is that any wheel which takes the tread gage should be remounted, regardless of bore size. There should, of course, be some limit on the excess size of the bore and the Wheel Committee recommends that this limit be placed at ⅛ in. The opponents of this practice have maintained that the railroad companies can use up the wheels by applying them to their own equipment, but this argument is not well grounded, for if the rule is interpreted as above mentioned, when this railroad company's own equipment goes on foreign lines and a wheel has to be removed on account of axle defect, the owner is subject to billing for this wheel at scrap value only, which appears unjust and will result in the discontinuance of the practice of using large bore wheels.

Grinding Cast Iron Wheels

In the 1923 report, the Wheel Committee made a strong recommendation for the practice of grinding slid flat cast iron wheels and also suggested that railroads consider the grinding of new cast iron wheels where machinery was available in order to make them truly round. We regret to state that there has been little development of this practice of grinding wheels. We wish to again recommend that this matter be given careful consideration, as we feel there is a great economy to be effected thereby. In this same connection we would recommend that the Arbitration Committee give consideration to some change in the rules which would give recognition to the ground wheel as a proper wheel for application to foreign cars. Under present rules, exception is taken by some roads to the application of these wheels. All the evidence which we have indicates that the ground wheel is on the average a better wheel than the average run of second-hand cast iron wheels.

Limit of Wear of Rolled Steel Wheels

The question has been raised as to why it was not permissible to use rolled steel wheels down to the freight car limits of ¾ in. under switch engine tenders. Some carriers feel that this is a simpler way to use up the scrap wheels out of their road locomotive tenders. The Wheel Committee can see no objection to such practice, since cast iron wheels are used on many roads for this same service. The Governmen rules, however, set a limit on this service of 1 in., and it will, therefore, be necessary to have this changed before a railroad can wear the wheels to ¾ in. The Wheel Committee therefore recommends that the ¾ in. limit be adopted as standard for rolled steel wheels in switch engine tender service, provided the Bureau of Locomotive Inspection of the I. C. C. is willing to change its rules accordingly.

Request was received from one carrier for reduction in limit of wear of rolled steel wheels in passenger service to ¾ in., the same as freight service. While there is a possibility of such a reduction, there is not sufficient evidence available at present to warrant making this change. They would prefer to wait until further evidence is available from service which is rendered by rolled steel wheels worn to ¾ in. limit in freight service. A theoretical analysis of the wheel dimensions indicates that the lower scrap limit would be safe for passenger service, but the committee feels that the theoretical estimate should be backed up by more service results than are at present available.

Figure 1—Page 24

The committee wishes to call attention to error shown in last year's report, covering limiting dimension for rolled steel wheels. In the bottom figure the arrow, after the words "measuring line for thickness of rim," should point to the line passing through the intersection of line A-B and the tread. This drawing will be corrected in next year's Manual of Standard and Recommended Practice.

Manual of Wheel Practices

The Wheel Committee feels that the enormous amount of money involved in the use of wheels and the great possibilities in savings due to following the best practices are so great that a complete manual of instructions regarding wheel practices should be issued by the Association. This manual should be in such form that it can be given to all railroad employees who are directly involved in the handling of wheels, either on repair tracks or in the shops. If they can be educated in this way, the railroad companies would undoubtedly benefit. Your committee, therefore, plans to work up such a manual and has outlined the following schedule of subjects for same:

Kinds of wheels,
Methods of manufacture,
Wheel specifications,
Wheel inspection at plant,
Storage of wheels,
Mounting of wheels:
1. Turning axles—Limits of wear,
2. Boring of wheels,
3. Press work and gauging.
4. Shipment of mounted wheels and storage.

Wheel defects:
Cast iron,
Rolled steel,
Steel tired,
Cast steel.
Wheel lathe work.
Wheel grinder work.

The preparation of this manual involves a large amount of work and it has proven impossible to have it prepared in time for this year's convention, but it is hoped that this work can be carried to a conclusion within the coming year and results presented for your approval.

This report was signed by C. T. Ripley (chairman), chief mechanical engineer, A., T. & S. F.; G. N. Prentiss, engineer tests, C., M. & St. P.; E. W. Smith, general superintendent motive power, Pennsylvania System; O. C. Cromwell, assistant to chief motive power and equipment, B. & O.; A. Knapp, assistant consulting engineer, N. Y. C.; and H. M. North, president's office, The Pullman Company.

Discussion

H. W. Coddington (N. & W.): Under the caption "Marking of Rolled Steel Wheels," reference is made to the complicated markings that appear on the rim of some of the rolled steel wheels in service and with which the railroads have to deal in their identification of wheels in the process of billing. It does appear that some relief might be readily provided in this connection if some uniform method of identifying the number to be used in billing could be agreed upon.

It is realized that the various roads have their own individual ideas as to the number to be used in reporting their wheels. On the Norfolk & Western we prefer the road number reported in such billing, while other roads are agreeable to having the wheel identified by the manufacturer's serial number, but the foreign inspector who handles wheels of various roads is altogether in the dark as to what number should be reported. We cannot conceive of any occasion for reporting all of the markings on the wheels unless it should be a case of wheel failure which had resulted in an accident. In interchange accounting it seems that the date and manufacturer's serial number or the road initial and number is all that is necessary. It also seems reasonable that the railroads now requiring the road initial and number would be agreeable to having the wheels identified by the date and manufacturer's serial number provided the road initial is also shown. The A. R. A. specification does not specify road initial or number. If this specification was modified and the road initial specified, it appears that a uniform method of wheel identification in billing could be established by enclosing the date and manufacturer's serial number in brackets and instructions issued for only the road initial and the bracketed numbers to be used in billing. This suggestion will no doubt meet some objection on account of the additional markings required, and the manufacturers at least will scarcely welcome the specification for an additional marking. The manufacturers, however, under such a practice, would probably be fully compensated by the elimination of cold stamped road numbers.

Nevertheless, when the number of times a wrought steel wheel may be handled in the course of its long period of service, which some have estimated to be as high as 30 to 40 years, is considered the additional marking required to establish a uniform method of wheel identification in billing seems fully justified.

Although the number is limited, wrought steel wheels that burst in mounting, or crack through the plate without any apparent physical reason, indicates there are certain inherent stresses in some wheels that are the initial and contributing causes of such failures.

Reference to wheel mounting gage to our mind represents a step in the line of progress, as we do not consider the existing A. R. A. wheel mounting gage, which was primarily designed and adopted for use in mounting cast iron wheels, adaptable to the best practice that might be followed in mounting steel wheels. The committee has suggested that a spacing gage of 55⅜-in. in length to be used for gaging between the back rim surfaces in spacing steel wheels.

We presume the committee arrived at this dimension as the sum of the "Inside gage of flanges of 53-7/32 in. and 5/32 in., the difference in thickness of two cast iron flanges and two wrought steel flanges measured at the gaging points. Wheels mounted to this recommended spacing of 53⅜ in. will be ⅛ in. below the maximum allowable spacing and 9/32 in. above the minimum spacing as regulated by the standard wheel mounting and check gage. It would be consistent with good practice and decidedly in favor of reduction in flange wear to adopt as a standard practice for steel wheel mounting a check gage more nearly approaching the minimum than the maximum spacing.

The I. C. C. manual governing the inspection of locomotives and tenders, Rule 144 (b), specifies "Wheels used on standard gage tracks will be out of gage if the inside gage of flanges, measured on base line, is less than 53 in., or more than 53⅜ in. Wheels mounted to the 53⅜ in. spacing recommended by the committee, would be mounted to maximum limit prescribed by the I. C. C. rule.

The standard A. R. A. wheel mounting and check gage will not, on account of the contour of the inside gaging surfaces, permit steel wheels to be mounted to the minimum spacing of 53-3/32 in. prescribed by the present A. R. A. gage. Steel wheels with flanges conforming to the standard contour may be mounted within 7/32 in. of the minimum or spaced 53-5/16 in., but wheels with flanges not conforming on the inside surfaces to the standard contour will be restricted to even a greater minimum spacing, and it is generally known that very little attention is given to the maintenance of the standard contour on the back of the flange.

In the interest of better mounting practice and economy in steel wheel flange wear the Norfolk & Western is using a special gage for the mounting of steel wheels. This conforms to the A. R. A. standard gage in every respect, except where the gage contacts with the inside surface of the flange this contact line is straight and perpendicular to the base line. The spacing dimensions of the gage are 4 ft. $5\frac{3}{32}$ in. minimum; corresponding to the A. R. A. gage, and 4 ft. 6⅜ in. standard distance, which permits of the same tolerances as prescribed by the A. R. A. page when applied to cast iron wheel mounting. With this gage the maximum dimension is 4 ft. $7\frac{21}{32}$ in. as against 4 ft. $7\frac{13}{16}$ in., the present A. R. A. standard. Note the difference is $\frac{5}{32}$ in., which corresponds to the difference in flange thickness of two cast iron wheels and two steel wheels. The gage used on the Norfolk and Western may be used in mounting second-hand wheels, as sufficient clearance for increased flange height is provided.

Using the standard A. R. A. gage, if steel wheels are mounted to the maximum spacing, the space between the flanges will be 53½ in. or ⅛ in. in excess of that specified by the I. C. C. rules. Using the special steel wheel mounting gage, wheels mounted to either the maximum or minimum dimension will come within the I. C. C. specification.

There appears to be more or less divided opinion as to the value of the amount of taper applied to the tread contour of car wheels. This is true of both cast iron and steel wheels. No better illustration as to diversity of opinion can be cited than that mentioned in the report, where two representative railroads, both well equipped for determining the significant value of modification of contour, recommend practices at wide variance. In the study the committee anticipates making of this subject, the character of the road over which the tests are made should be given equal consideration with the variation in taper. Operating over a district where numerous curves are encountered, it is reasonable to expect that increased coning may contribute to conservation of flange metal. In the negotiation of curves some compensation must be made for the difference in the distance traveled by the wheels on the inside and outside of the curve with reference to the track. If this condition is not relieved by the coning, the outside wheel will of necessity track well up along the flange, resulting in both flange and rail wear, and sometimes, under favorable conditions, will contribute to the derailment of the wheel over the outer rail.

In the publishing of a Manual of Wheel Practices the committee has before it a field of endeavor that should be productive of splendid results. Take, for instance, the subject of wheel boring and mounting. There is no question but what improvement can be made in our mounting practices to the extent that the number of loose wheels will be greatly reduced. It may be in the minds of some that they do not experience any trouble with loose wheels, but if they will take occasion to compile for a 12 or 18 months' period the number of derailments in which loose wheels have been involved they will not only be surprised at the results, but will get a better conception of the importance of closer attention to this feature of wheel handling.

It is not necessarily indicative that a wheel is properly mounted when the required pressure is developed in the process of mounting. The proper preparation of the engaging surfaces is of even greater importance than the mounting tonnage. A smoothly bored wheel mounted on a roughly turned axle may, by virtue of the roughness of the axle surface, develop the required pressure in mounting, but after such wheels get in service and the crest of the took markings begin to seat themselves in the surface of the wheel, the consequence can be none other than the development of a loose wheel.

The proposed manual should give consideration to the proper practices to be followed in wheel and axle preparation before mounting. Consideration should be given to recording the mounting pressures; at least a record should be kept of the pressures at which wheels are mounted, an automatic record of the mounting pressure is even more desirable as such a record indicates how well the wheel is fitted by the uniform increase in pressure as the wheel is pressed on. So far, the use of recording pressure gages has been limited to single presses. It would be a great asset in wheel mounting if some scheme were devised whereby recording pressure gages could be used on double presses and a record made of the individual wheel pressures.

Special attention should be given to shop practices and the handling of wheels at terminals and repair yards in order to stimulate interest and maintain the work at the required standard. It will be found very helpful in this

respect to have a man familiar with the best wheel shop practices make a canvass of the different wheel shops every four or six weeks. In making these periodic visits the equipment used in the wheel shop should be inspected as to condition; the shop tools should be gaged as to conformity with the master gages, the practices followed and the quality of the work turned out should be carefully scrutinized. This course of procedure will have a splendid influence on wheel shop performance. The manual which the committee proposes publishing will furnish a basis upon which a more efficient wheel handling organization may be constructed, but it must not be overlooked that the manual and competent supervision must go hand in hand if the best results are to be obtained.

G. E. Doke (N. Y. C.): The action of the committee in recommending that no wheels of less than the nominal weight established by the specification committee should be considered, is commendable and would suggest that this table be extended to include the 850-lb. wheel.

Question was raised with us several times during the year as to whether the marking "A. R. A." signified that the wheels so marked had been made to A. R. A. wheel specification. My thought in the matter has been that a cast iron wheel cannot properly be marked A. R. A. unless such wheel complies with the A. R. A. standards, both as to design, composition and other specification requirements. This matter has been nicely covered by the committee in its recommendations to the Arbitration Committee.

The value of more careful practice in the manufacture of cast iron wheels is emphasized when we note that on the New York Central, 21.8 per cent. of all our failures of cast iron wheels, during the past 16 months, were occasioned by the presence of dirt, slag, porosity, etc., in the plates of the wheels. Another large contributing factor, which caused the failure of 30.9 per cent. of these wheels, was found to be hard, brittle iron in the plates and hubs.

I believe you all realize that specifying composition will not alone enable us to obtain satisfactory cast iron wheels. We must also have, coupled with this, good foundry practice and for this we must depend entirely upon the cooperation of the cast iron wheel manufacturers. Proper cupola practice, carefully skimming the ladles to assure clean iron, prompt pitting of the hot wheels, and the proper preparation and care of the pits are equally essential. Possibly no one operation in the manufacture of wheels is more responsible for obtaining a good or bad wheel than the pitting.

In the mounting of cast iron wheels, the committee has called attention to certain points with reference to the use of the present mounting gage. If properly used, this assures satisfactory mounting of cast iron wheels, insofar as the relation of the flange of one wheel to the flange of the mate wheel is concerned. However, the gage does not assure that the throat radius of the flange of either one of the wheels will be mounted with proper relation to the center of the journal. As you are undoubtedly aware, 75 per cent. of the 90 per cent. of all of the cast iron wheels are removed from service on account of vertical flange wear on one of the wheels of a pair. Very seldom, is a pair of cast iron wheel removed on account of tread wear. Thus, it is apparent that only a fraction of the possible life is obtained from the big majority of cast iron wheels removed from service.

A large number of thin flanges occur on account of the manner in which the wheels are mounted. Usually, the first wheel is pressed into place on the axle with the use of a cast iron pushing block which is attached to the plunger head of the wheel press. This block comes in contact with the hub of the wheel and pushes wheel on until the end of the axle comes to a seat in the central hollow portion of the push block. The mate wheel is then pushed on, checking the mounting of this wheel with the use of the mounting gage.

In some shops, gages are used to check the distance of the hub of the first wheel mounted from the end of the axle. This simply checks the work of the push block and does not indicate location of the flange with reference to the center of the journal. In case the cast iron wheel first mounted has a swollen hub, the wheel is, with the ordinary mounting device, pushed too far on the axle, and, as the mate wheel is mounted to the flange of this wheel, the last wheel applied will be much too close to the center line of the journal. This will, in the majority of cases, be the wheel on which the flange will wear rapidly. The reverse would be true if the first mounted wheel had a shrunken hub. To assure proper mounting of the wheels on an axle, the first wheel mounted should be so mounted that the relation of the flange to the center line of the journal will not vary over 1/16 in. The mate wheel can then be properly mounted and spaced with the use of the present mounting gage.

On the New York Central we are experimenting with gages which check the mounting of the first wheel and expect to have one ready for general use at an early date. One of the gages considered checks the relation of the flange of each wheel to the center of the axle. Obviously, to properly use this gage the center of the axle must be carefully located and marked before the wheels are mounted. One of the bad features in connection with the use of this gage is the manner in which the center of the axle is sometimes marked. In certain cases it has been found that a large prick punch had been used and a hole of considerably greater size than necessary has been made. Other cases have been found where a flat chisel had been used, making a straight, sharp indentation across the axle at the center. We are opposed to any practice which would result in heavy, deep indentations being made in the center of the axle. Another gage which we are considering locates the relation of the flange of the wheel to the end of the axle. The use of this gage has been very satisfactory, and a check of over 2,000 axles shows variation in length does not exceed 1/16 in.

I have noted that frequently mounted wheels are shipped without proper blocking on the car. This has resulted in sharp, wedge shaped indentations being made in the axles. These indentations have in some cases been over ⅛ in. in depth, the metal being swollen out on both sides. Fortunately, in those examined, the indentations were located fairly close to the inside hub of the wheel.

Recently, two axles have failed in service where sharp grooves were in evidence in the center of the axle. Upon examination, the material in the axle was found to be fully up to the standard requirements, the check or proggressive fracture having started from the sharp nick or indentation which had been beaten into the axle by the flange of a cast wheel.

It is suggested that the committee include in the Manual of Wheel Practice, specific and emphatic reference to proper loading, blocking, etc., of mounted pairs of wheels which are to be shipped.

The new standard steel wheel gage is a decided improvement over the old gage and is much easier to handle and use with accuracy by the average workman. The addition to the gage, of six points, to enable the user to obtain flange height and pass on tread-worn hollow wheels appears desirable.

Cast iron wheels should be checked for rotundity after mounting and any eccentricity permitted should be confined to the limits for out of roundness set forth in the

present A. R. A. cast iron wheel specification. No hardship need be inflicted for properly checking the wheels. A lathe with centers is possibly preferable, but check can also be made with the proper gage, resting on the journal. In fact, this same gage can be used for checking the rotundity of a wheel and the proper mounting of a wheel, insofar as relation to the flange to the center of the journal is concerned.

We have had several cases of failed wheels where they have been found to be very badly out of round, and in other cases where the eccentricity is due to the manner in which the hub of the wheel is bored. In the case of a recently costly derailment, it was found that one of the wheels which caused this derailment had a badly worn flange still lacking 1/32 in., however, of being worn to the condemning limit. It was also found that the tread of both the worn flanged wheel and the mate wheel were eccentric with relation to the journal by over 3/8 in.

It is very desirable to obtain truly round wheels, and for this purpose grinding of treads of cast iron wheels should receive due consideration. If treads of wheels are ground the work would undoubtedly be performed upon lathe centers and all of the high spots and eccentricity removed. This would be especially desirable in case of cast iron wheels, which are manufactured in what is know as contracting chillers.

C. J. Juneau (C. M. & St. P.): I have read with very much interest the paper compiled by the wheel committee and I believe that commendation is due this committee for the able manner in which they have brought forth the different items pertaining to wheels and their care.

On the top of page 12 I concur in everything the committee says on grinding of cast iron wheels and that the practice should be extended, but I would like to ask whether they would recommend the grinding of cast iron wheels dry or wet?

Mr. Ripley: I think the only practical type of grinding is the wet grinding.

Mr. Juneau: I move that in order to protect the railroads on account of billing for such work all mounting of wheels be made with recording gages in order properly to protect and to keep us advised as to the pressure at which the wheels were mounted. (*Motion seconded.*)

R. L. Kleine (Penna.): I would suggest that the matter be referred to the Wheel Committee for its consideration rather than passing on it by a motion from the floor. If in order I amend the motion to refer the matter to the Wheel Committee for consideration.

Mr. Juneau: I will accept that.

(*The motion as amended was carried.*)

Mr. Purcell: Mr. Chairman, I move you that the report be accepted and the changes be submitted to letter ballot.

(*The motion was seconded and adopted.*)

Rules of Order Amended

Mr. Brazier: Years ago our by-laws were different than they are today. For some reason omission was made. I know that we are all God fearing people, and I move that the Rules of Order be amended so that our annual meetings be opened with prayer, and that this be referred to the General Committee to take action as they think best.

(*The motion was duly seconded and unanimously adopted.*)

(*The Mechanical Division then adjourned.*)

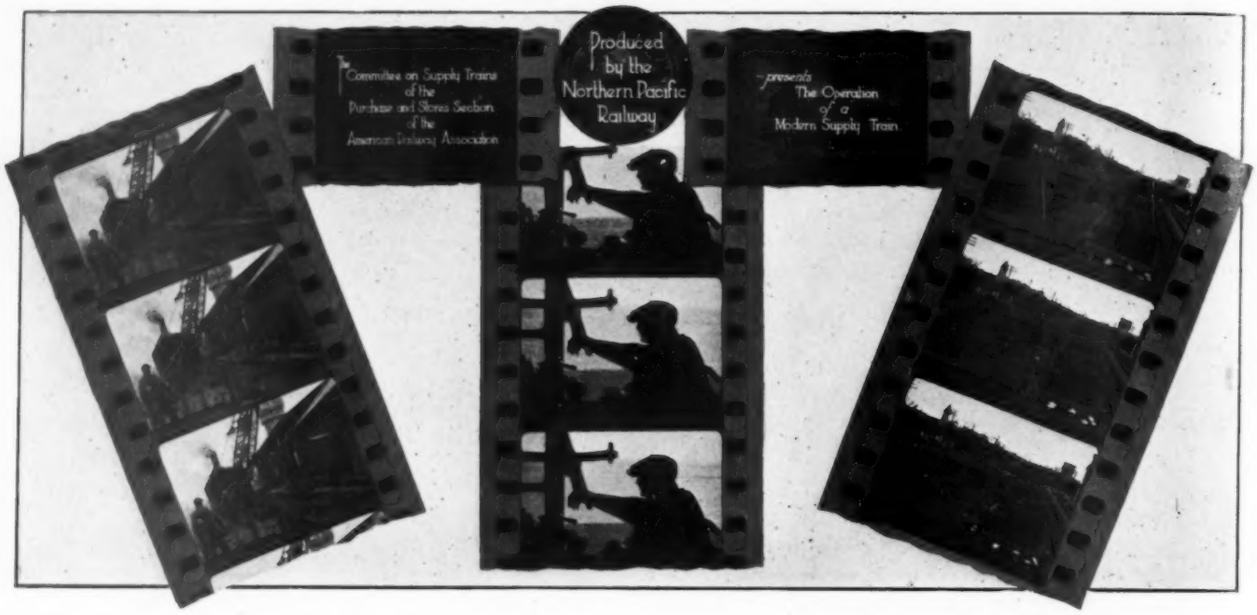
C. I. C. I. and C. F. A. Convention

W. T. Westall, president of the Chief Interchange Car Inspectors and Car Foremen's Association, visited Atlantic City Sunday. Mr. Westall reports unusual interest in the activities of his association. The meeting to be held September 21, 22, 23, 1924 at the Hotel Sherman, Chicago, is expected to break all records for attendance. The membership has nearly doubled in the last six months.

* * *

Division VI—Purchases and Stores Officers and Executive Committee

Left to Right:—H. H. Laughtor, Asst. to V. Pres., Southern; A. S. McKelligon, G. S. K., So. Pac.; H. C. Pearce, Director Purchases and Stores, C. & O.; John Marshall, Pur. Agent, C. & A.; W. J. Farrell, Sec. Div. VI; F. D. Reed, Vice-Pres. and G. P. A., Rock Island; C. D. Young, Stores Manager, P. R. R.; W. G. Phelps, Pur. Agt., P. R. R.; A. W. Munster, Pur. Agt., B. & M.; D. C. Curtiss, G. S. K., C. M. & St. P.; U. K. Hall, Gen. Superv. Stores, U. P. System; Wm. Davidson, G. S. K., Ill. Cent.; E. W. Thornley, Asst. to P. A., B. & O.; J. G. Stuart (Rear), G. S. K., C. B. & Q. and E. H. Hughes, G. S. K., K. Cy. So.



Division VI—Purchases and Stores—A. R. A.

Program of the Third Session With One Exception is Devoted Entirely to Committee Reports

THE THIRD day's session of Division VI was called to order by Chairman Hall at 9 a. m. With the exception of one special subject, a paper on the opportunities of a traveling storekeeper, the program was entirely made up of committee reports. These reports included unit piling of material, purchasing agents' office records and organization, reclamation of material, classification of material, fuel conservation and others, all of which were taken up in the order given. This was the concluding session of Division VI.

Opportunities of a Traveling Storekeeper

By W. W. Williams
Traveling Storekeeper, New York Central

The duties and opportunities of a traveling storekeeper have been treated from a very interesting and likewise important viewpoint by Mr. Williams. This viewpoint contemplates a much-needed similarity in the activities of the traveling auditor and the traveling storekeeper. It has been pertinently pointed out that the railroads protect their cash receipts by every known method. Traveling auditors constantly patrol the system for this purpose. Cash in the form of material has not had this detailed consideration, but offers a real opportunity for development to the traveling storekeeper that is much greater than that of the auditor, since he may act, in many ways, as ordering, receiving, storing and disbursing officer.

Railroads surround their cash receipts with every form of safeguard and spare no expense to protect them. Traveling auditors are constantly patroling the line, checking up the accounts of the receiving agents. Contrast this with the care exercised over these same receipts after they have been changed into material.

The traveling storekeeper is the traveling auditor who patrols the line. The stock of material is scattered over the entire railroad. This on the larger roads means stores separated by magnificent distances, stores in as many states as the railroad traverses, creating problems in control. The amount of money tied up is often larger than it should be. Analysis of the figures indicate that where money is tied up in unnecessary materials it is an unproductive investment. It is this investment which offers the traveling storekeeper his great opportunity. An opportunity which

is three-fold greater than that which is offered to the traveling auditor for the traveling auditor concentrates on caring for the cash receipts, while the traveling storekeeper has opportunity in ordering, receiving, storing and disbursing of the cash after it has been changed into material.

I wish to refer to one of these opportunities. That is "Ordering" which is the first and most important act in "Changing cash into material" and to the "Stock Book" which is "The key to stores success."

Stock Books Are Cash Books

The first duty of the traveling storekeeper in his work which I have called the work of the traveling auditor is to know that no material has been ordered until proper stock record has been made. This is absolutely necessary as the stock books are the cash books of the stores department. Without them we could not function, for they tell us, (1) what we had; (2) what we have; and (3) what we need.

With a certain amount of equipment handled annually it is only possible to use a certain amount of material. Any error in ordering will mean a surplus or delays, waiting for material. Either of these conditions are costly, so costly that the roads cannot afford to have them.

The Control of Material

The traveling storekeeper in patroling the line will base all his work for the control of material on the stock books. His first check at a line store will be a check of the stock books to determine that description shown is complete, as this description will appear on requisitions and errors will result in shipments delayed or in material that does not meet requirements. Delayed shipments cause loss of shop output, delayed construction and expense that goes with no stock. Material that does not meet requirements causes extra expense in its use or a total loss where it cannot be used.

The next check will be to determine that the proper material is ordered for each purpose. This will result in proper flow of material to points of consumption without the expense and delays incident to efforts to use wrong material.

A third check will be as to the accuracy of the stock record found in the stock books. Unit piling and other modern methods employed in storehouses, have taken guess and estimate out of the periodic stock taking and in so doing have taken many of the elements of chance control out of ordering material. These methods have not eliminated the human element. This one element which is of greatest concern to the traveling auditor who cares for the cash, must be of great concern to the traveling storekeeper who cares for the cash when it is changed into material. An error in count may mean under ordering which increases the unnecessary investment, and the expense of store and often means a stock of parts that finally becomes obsolete and a total loss.

The fourth check of the stock books will be a comparison of the amounts used currently with amounts on hand to determine surplus available for transfer to other stores. Changing conditions on one division often release material which can be used for normal purposes elsewhere or to meet emergencies. Saving many dollars in purchases also in operating expenses as a result of having material at once to meet the emergency.

Conditions Cause Demands for Unusual Amounts

The final check will be a study of the amounts ordered in view of the requirements as shown by the stock book records. Conditions are continuously stampeding using forces to demand unusual amounts of standard material. Storehouse men being under the hammer of shops demands may forget that with a certain amount of equipment handled annually it is only possible to use a certain amount of material and the stock books data gives them an irrefutable picture of what the amount will be.

Another feature of the traveling storekeeper's work which is a great opportunity is directly related to "Stock Books and Ordering Material." It is material for addition and betterment, and material for authorized improvements. There is no stock book basis for ordering this class of material. It must be based on the work to be done and the probable date of requirements. For proper handling it must not be ordered until proper stock book entries have been made. The record must be kept in the stock books, so that proper data may be built and flow of material controlled to assure material being on hand when wanted, but no so far in advance as to hold the material investment unnecessarily high.

The study of the question, "Stock Books and Ordering Material," proves conclusively that the stock book is the key to stores success and that it gives the traveling storekeeper his only opportunity in the ordering of material that is based on real irrefutable facts.

Discussion

C. D. Young (Penna.): Mr. Williams' paper said "Storehouse men being under the hammer of shop demands may forget that with a certain amount of equipment handled annually it is only possible to use a certain amount of material." In everything on the railroad, the stock book is the best guide for the future. In other words, the best judge to measure the future by is the past. On the Pennsylvania, we are now inaugurating a plan of control locally of maintenance of way stocks based upon physical characteristics of the property to be maintained. We take a certain section of the railroad and get the amount of material, major material in the roadway construction, whether it is different weights of rails, signals, or what not, and basing the estimate upon the physical condition, we allow a certain amount of stock representing money for the protection of ordinary maintenance outside the summer construction work. I believe that after this scheme has been working for a number of years we will find that by taking the physical characteristics of the property combined with the stock card record that there will be a measure of how much material we should have in stock to protect it for ordinary maintenance. It it vitally important that the traveling storekeeper impress on not only the stockmen, but the officers themselves that the physical property they have to maintain is the best measure of the amount of stock, rather than their idea of what they think or would like to do.

Report on Unit Piling of Material

Reports submitted in previous years brought out very conclusively the numerous advantages that could be derived by the application of the unit piling system to modern stores department practices, and for the purpose of obtaining further light on the subject, a questionnaire was prepared and sent out to 72 of the Class 1 roads, which questions and information obtained are incorporated into this report.

Section 1—Unit Piling of Materials

Question 1.—Has unit piling of material been adopted at your storehouse and storage yards?

Forty out of 45 of the roads replying, favor this system of storing materials, and since the last report have extended the practice to such an extent that in nearly all cases it has been installed to cover practically all items carried in stock.

Question 2.—Do you use trays in connection with the storage of material on shelves?

Trays are universally favored for the purpose of separating and storing all material carried on shelving.

Question 3.—If trays are not used, what provisions are made to segregate the various items?

Local conditions and style of shelving have in a great many cases created ideas which appear to answer requirements. For example, flat sheets are used where racks are sub-divided into small pigeon-holes; while some roads do not make any attempt to separate the items into units, but arrange the piles in such a way that a conservative estimate can be obtained. It has been demonstrated that the tray provides the most efficient and economical means of storing material.

Questions 4 and 5.—Do you follow the practice of showing the accumulative count on the front of each tray, piles of castings, forgings, sheets, flues, lumber, etc?

Replies received indicate a universal practice in this respect. The policy of showing the accumulative count materially assists

in taking monthly and annual inventories as the exact amount on hand is constantly before the stockmen.

Question 6.—How often are all items of material on hand accurately counted for inventory or requisitioning purposes.

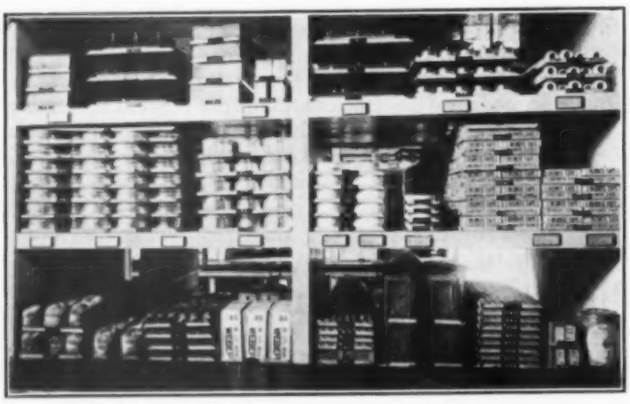
Where the unit piling and features of accumulative count are not used, an accurate count is taken at least once a year for accounting purposes, and is accomplished by removing all material from shelving. Where unit piling is in effect, an accurate count can be obtained at any time desired, as the items are counted when stored on trays, and the correct amount shown on the tray, or piles, thus making it unnecessary to again handle the material until issued.

Question 7.—What saving of time is made in taking monthly and annual inventories by this system over former methods?

Answers from roads following the unit piling system and practice of showing accumulative count indicate an actual saving of 50 per cent in time over previous methods.

Question 8.—What saving of rack and floor space has been made by the adoption of this system?

The replies received show conclusively that a saving in rack and floor space of 25 per cent has been made, accomplished by more compact method of storing material on shelves, use of unit or island platforms for segregation of heavy and bulky items, and the paramount feature of properly storing all classes of material.



Methods of Piling Miscellaneous Items on Trays

Question 9.—What figures can you furnish as to the cost of installation?

The initial cost of installation varies. The most essential requisite is the tray, manufactured from scrap metal roofing, costing approximately five cents each, and metal markers to carry the accumulative count, which can be produced at an insignificant figure. The work of making trays, markers, etc., has in nearly all cases been handled by regular forces at odd times, and the change-over made gradually.

Question 10.—What saving in money have you accomplished by this system?

At first thought, the idea of providing the required number of metal trays would seem to be an exorbitant and unnecessary expenditure. Railroad storekeeping today demands the control of stocks with a minimum investment. These essential requirements cannot be obtained without the very latest and most accurate methods, which are primarily based on accurate stock book records, governed entirely by proper count and correct consumption.

In any event, material received has to be placed on the shelving, once, if thrown in without any semblance of order, the cost would be small, and would appear to be an economical practice. Material thrown promiscuously into bins cannot be counted, or even estimated correctly, unless removed, and this operation entails an unnecessary amount of time and additional help. With the tray system and the accumulative count, the material when received is carefully piled and counted into trays, or properly stored on unit platforms or ways, and the actual amount in each container or layer shown when first stored. Where stock book records are maintained on the basis of absolute quantities on hand, secured by monthly inventories, the count already provided, plus the number of loose items in the top (working) tray or layer furnishes instantly the information desired. Compare the accuracy and promptness of this system over past practices.

The tray eliminates the necessity of costly rack construction by allowing open type shelving and the use of metallic sub-dividers. Material can be stored to the full height of the shelf, and where it was necessary to waste valuable space with single items and small quantities, they are now placed one above the other on sud-dividers that can be removed at will.

Constant changing of power and equipment necessitates numerous additional items being provided for, with the result that unless some efficient plan is adopted, storage facilities must be increased. It has been demonstrated, however, that where the unit piling system has been put into effect, sufficient space has been acquired to take care of the steady increase to date.

It was, therefore, the unanimous recommendation of this committee that the unit piling of material, with accumulative count on all items, be considered recommended practice on all railroads.

Several years ago the Committee on Subject 11, in presenting its report made two distinct divisions of the subject which did much to clarify the general understanding of the subject of unit piling. These divisions clearly demonstrated what was meant by unit piling and by a numerical marking system. Previous reports of the committee have pointed out the various advantages obtained by using unit piling. However, it was felt desirable to obtain the latest thought on this question and in order to secure the actual results which have been obtained a questionnaire was sent to 72 roads. The questions and answers are incorporated in the report. It is interesting to note that 40 out of 45 roads replying use unit piling and have extended the system to include practically all items carried in stock.

J. L. Sullivan
Chairman

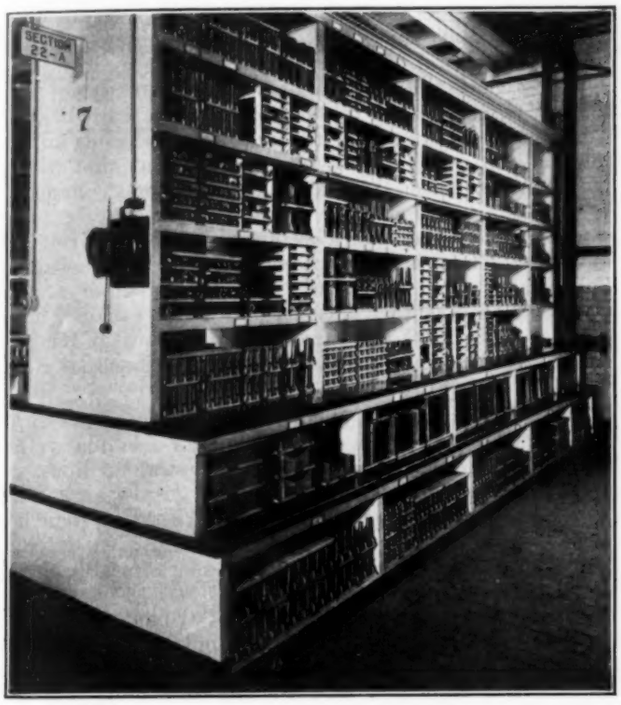
Section 2—Numerical Marking System

The numerical marking system was introduced into stores department practices some few years ago for the purpose of identifying material by number as well as by description. This system is controlled in the office of the chief supply officer through a master book or catalogue, and is used on all records, including price books. All items of material are grouped into classes or sections, and arranged alphabetically and in numerical sequence. Each item is assigned two numbers separated by a dash. For example: Axes, in Class 36, would be shown 36-30, the first group of figures representing the class or section to which the material belongs, and the second group the symbol number given to the article in its proper catalogue or stock book order.

So as to have the system as expansive as possible, sufficient numbers are left open to take care of new items and to allow the material to be properly listed in alphabetical order. All corrections and additions are first made in the master book and then transmitted to the various stores on the system. In this way a uniform method is followed, and all concerned are thoroughly familiar with the changes which are made at all points simultaneously.

The use of reference numbers curtails the amount of description on requisitions, charging out documents, etc., without taking the risk of items being misunderstood. Delivery men show the proper numbers on shop delivery tickets, which have incomplete description, which enables the clerical force to apply the correct price, which in many cases would not be accomplished if they had nothing more than pet shop names to work on. Also, the item is correctly classified by men familiar with the material, and not left to inexperienced help.

Above all, it affords an accurate and uniform system for the preparation and maintenance of stock records, and creates efficiency by reducing the element of error in ordering and accounting for material.



Open Type Shelving With the Tray System

The committee for 1923 included in its report, questions and answers received to questionnaire submitted to a majority of Class 1 roads, and recommended that consideration be given to the further continuance of the subject. The committee, therefore, prepared and sent out a questionnaire, and have incorporated the questions and replies into this report as follows:

Question 1.—Do you follow the practice of assigning reference numbers to each item in addition to name?

Eight roads out of 45 replying, use a system of this kind.

Question 2.—What record is maintained to insure proper record of reference numbers?

Several roads using numbering systems maintain a catalogue from which all numbers for new items are issued, and one or two furnish new cards, etc., from addressograph plates.

Question 3.—To what extent are these numbers used?

Roads following this practice assign reference numbers to all stock items.

Question 4.—Are reference numbers assigned to air brake material, brass and iron castings, or other items previously covered by manufacturers' numerical references?

Roads in favor of this system use on air brake material, the manufacturers' numerical piece number, and manufacturers' or railroad company's pattern numbers on all castings.

Question 5.—Do you use reference numbers on charging out documents, purchase orders, receiving sheets, price books, etc., only, or both description and numerical reference?

Roads using advise that reference number and proper name are used on all documents.

Question 6.—Are reference numbers placed on the items and what value is derived from so doing?

Answers received indicate that it is advantageous to stencil or otherwise mark this reference, wherever permissible, on the material.

Question 7.—What force is necessary to maintain a system of this kind?

The eight roads advising that they follow out the numerical marking system, in its entirety, claim that they handle the work with regular forces.

Question 8.—What advantage is gained by the use of reference numbers?

Answers in favor of system claim a uniform method of referring to items of material on the railroad, facilities the pricing of all documents, in that a number is more easily located in price books than a name.

The Materials are Protected by Being Properly Stored on Trays

Question 9.—What are the disadvantages of assigning reference numbers in addition to proper names?

This question favorably answered by the eight roads using, but the consensus of opinion of the remaining 37 roads answering

An Example of a Unit Platform

is that the use of numbers in addition to proper name might add to the chances of confusion, which is lacking when items are shown by name only. While the use of numbers assists clerical forces, it tends to detract from the efficiency of material handlers, as they become more familiar with numbers than names.

The committee recognized many good features in connection with this method and recommended that the subject be continued.

Committee: J. L. Sullivan (U. P.), chairman; J. C. Gann (M. P.), S. I. Gowland (Penna.), J. E. McMahon (C. St. P. M. & O.), H. M. Smith (N. P.), L. B. Wood (S. P.), J. G. Stuart (C. B. & Q.), chairman *ex-officio*.

Discussion

E. W. Peterson (Bangor & Aroostook): Couldn't you do away with the clip which shows the count on a standard tray by simply using the edge turned up and stenciling the cumulative account? That is the way we have been doing and we find that it saves the handling of clips and numbering.

J. L. Sullivan (U. P.) Chairman: The clip was the original idea and since that time we have been experimenting and following the idea that you just brought out. It can be worked any way it is the most convenient for the road handling it. The clip isn't necessary if some other way can be devised.

F. D. Reed (C. R. I. & P.): It costs money to keep house and it costs money to keep house properly. The whole question resolves itself down to how much money should we spend to keep house elegantly or sanely? There is nothing more important than the unit piling for storehouse operation. You can save a lot of time, you can save a lot of space, but you should not attempt to take tank rivets and material like that and stand them on their heads up in a row on the racks.

J. E. Mahaney (C. & O.): We have carried out unit piling for some time. In addition to unit piling we assign item numbers to every item of material except casting. We use the pattern number in distinguishing the casting. Our pricing system is known as the visible system from price cards. The makers of requisitions, storekeepers and others, with the exception of the shops, show on their requisition the store department item number. On castings, we assign one item number to locomotive plain iron castings, another number to locomotive steel castings, and so on. That is simply to assist the price clerks. It has been said that stock men will become more familiar with an item number than they will with material. I feel that that is rather far-fetched. You can't take away from a stock man his knowledge of material by the description or by assigning an item number to it. If you do, I don't consider he is much of a stock man.

On our shop requisitions the man issuing the stock over the counter or in his shop delivery enters the item number on the requisition in a space assigned for the purpose. To give you some idea of what that means to the price clerk, we still get requisitions calling for a coupler pocket, or a casting, or any name that the car builder sees fit to assign to it. But the item number assigned there by the man that knows what the article is at the time the material is issued, when that ticket or requisition reaches the price clerk, is what they look at. They pay no attention whatever to the description. They are governed entirely by the item number.

In our pricing bureau we have reduced the price clerks about 33 per cent. We take an annual inventory at all stores on the system, including the general store, once a year in not to exceed 8½ to 9 hours.

B. T. Adams (I. C.): We have found pans very useful in meeting the objection of Mr. Reed of standing rivets on their heads. We have a pan two inches deep for such items as small rivets and things of that kind. We use a counting machine in stocking the material, counting the number in one tray and identifying it with a number to show the quantity in each pan. The use of unit piling for lumber has been very beneficial. We have reduced the time for taking inventory on lumber one-third.

Mr. Reed: I am sorry the gentleman took me so literally. If we took small rivets and piled them on the heads, we would have an endless job. I brought it up as a ridiculous situation.

W. G. Hunker (C. R. I. & P.): We have done some unit piling but not to the extent that some other railroads have taken it up. The big feature that we have found in connection with it has been the saving in space. That has been approximately 25 per cent. We find that it gives us also a better check on our stock inasmuch as the counts are shown on the trays.

A. A. Goodchild (C. P. R.): The Canadian Pacific has not gone into the unit piling to any extent. For a great many years we have handled sheet metal, such as galvanized iron, by numbering each sheet as it is laid in the stock. We have done it also in regard to our lumber stock to a very considerable extent. There are a tremendous number of items for which, to me, unit piling does not appear economical. So far as rivets, bolts and pipe fittings are concerned, to think of piling these up when they come in from the shops, in trays, is simply a waste of time and energy. I can't imagine one of my men put on the job and piling these up in trays for the fact that within the month they are all out again and new ones coming in. It looks to me like a luxury. To use Mr. Reed's expression regarding good housekeeping, it is good if you can afford it. There is a lack of economy in this proposition apart from the question of taking an inventory. We only take an inventory once a year. Last year on a turnover of $7,000,000, our inventory came out at the end of the year within $70,000 of our book balance. I think that is a close showing.

G. E. Tallmadge (G. N.): We have reduced our store payrolls very materially in the last year. While we attribute a large part to increased mechanical facilities, we attribute a part to unit piling. About 25 years ago, our storehouse was getting crowded. Since this system has been installed, we find that the storehouse we have is sufficiently large and there is room to spare for all we need to carry at the present time.

J. C. Stuart (C. B. & Q.): Instead of piling up smaller material which of necessity has to go out in small amounts, like your smaller division stores or your roundhouses, we put it in sacks. We then have our orders made on the main stores in those units so that, for instance, if it was 1¼-in. pipe couplings, the man would order 25 or 50, whichever we happened to have in the sacks. Instead of placing such material on the shelves and then taking them out one by one, the stock man would simply take a sack, which saves considerable time in issuing. One point that I think is of great importance has not been brought out in recent reports, and that is the endeavor to make the units so that the man ordering from the outside will order in the same units in which you have piled. For example, if you are piling in 25's, he ought to order in 25's. If you have 25 in a unit and he orders 63, you have broken a unit and have to do counting. If he will order 50 (2 units) then your job is finished. I don't see why you want to number a great many of the articles which have individuality. The name is sufficient on items like bolts, and the size and the name is all you can get. We are wasting time when we go to the numbering system except in a few items which might be very hard to recognize. In almost every one of those cases you already have a numbering system.

C. D. Young (P.): The use of identifying numbers for the account and item is very beneficial. Whether you have the description complete by a size or not is not a vital matter in a small operation, but as the operation of storekeeping increases in size the issues become of greater volume and more money is involved in the value of the issues. It is essential to good housekeeping and good accounting to have an absolute identity to the material issued.

(*The report was accepted by the Division.*)

Purchasing Agents' Records and Organization

Owing to the various conditions with which different railroads are confronted it is exceedingly difficult, if not impossible, to develop a recommended form of purchasing organization which will be applicable to all conditions. This does not mean, however, that an outline or guide cannot be laid down to serve as a base upon which purchasing organizations of a fairly similar and efficient nature can be developed. The committee on Subject 12 has presented in its report a simple chart of a purchasing organization as a separate and complete unit. This is accompanied by a definition of duties, and together with the chart, forms a flexible basis upon which practically any road can build. In doing this the committee has kept in mind two recommended systems or methods of purchasing.

C. E. Walsh
Chairman

In submitting the following the committee felt that it was impossible to recommend a purchasing organization that would be applicable to all railroads because of the difference in mileage, local conditions and consequent variation in purchasing and office force required to handle it, hence it thought best to recommend but a simple chart followed by a definition of duties, a system which it believed to be sufficiently flexible to be used as a basis on which to work out an organization for railroads of different classes rather than to present a larger and more complicated chart and system which would perhaps apply to but one or two classes of railroads.

On some railroads where the stores and purchasing departments come under the same head, work which is shown on the chart as part of the purchasing agents' organization is handled by the stores organization. It has not attempted to detail such an organization but has shown only the purchasing organization as a separate and complete unit.

The committee in preparing the chart kept in mind two systems or methods of purchasing and for this reason reference such as is ordinarily shown on an organization chart indicating titled positions such as price clerks, invoice clerks, order clerks, etc., has been purposely omitted and the duties of a purchasing department shown, all in an effort to submit a chart enabling any railroad, regardless of size, to make use of either of the systems recommended, having in mind that the number of persons, together with suitable titles, should depend entirely upon the size of the property. The systems recommended are as follows:

System 1—Handling the detail work by sub-departments, sometimes referred to as price clerks, order clerks, delivery clerks, bill clerks, etc. By this method, all price inquiries and correspondence incident thereto would be handled by the price clerk, and tabulations would be made by the same clerk or clerks, and after the business had been awarded, it would be then passed on to the order clerk to issue the order, and then to delivery clerk or clerks to effect delivery, and finally to the bill clerk to check the invoices.

System 2—Having the work divided by material classification accounts and assigned to one or more sections, as the volume of work warrants. Under this arrangement, the section or sections would be responsible for the prompt handling of the requisitions, the issuing of the orders, delivery of the material, and the checking of the invoices.

Detail of Organization Chart, Purchase Division

5—Inquiries, Soliciting Quotations. Inquiries to be prepared:
(a) Standard form of inquiry for specified quantities.
(b) Letter or form when requesting quotations, for contract purposes or future purchases.
(c) Telephone, telegraph or personal solicitation.

Inquiries to be numbered, the time allowed for reply depending upon the need and character of material. Inquiries may be filed either in date, numerical or alphabetical order, or by material classification.

6—Tabulations. All bids should be opened on date received except sealed proposals on date specified, and tabulated on standard form of tabulation showing:
(a) Commodity.
(b) Unit of measure.
(c) Names of firms.
(d) Date of quotation.
(e) Prices.
(f) Terms as to discount, etc.
(g) Point of free delivery.
(h) Point of shipment.
(i) Time of delivery.
(j) Previous quotations and date.

Tabulation or requisition indicating successful bidder to bear personal approval of the purchasing officer or his authorized representative. Tabulation of bid may be filed by date, numerically, inquiry numbers, alphabetically or by material classification. Quotations may be filed, by firm name, or alphabetically as to commodity, or numerically by inquiry number or material classification.

7—Requisitions, Marking or Awarding Business. The marking of requisitions by indicating name of seller, date of quotation or contract number, price, point of free delivery, etc.

(a) From standard form of inquiry as described in 5-A.

(b) From record of quotations for contracts or other arrangements approved by the purchasing officer for future purchases as described in 5-B.

(c) From record of quotations obtained by telephone, telegraph and personal solicitations as described in 5-C.

(d) Mark to sellers or manufacturers without quotations such as repairs to and repair parts for machinery, etc., where it is not practical to obtain advance quotations.

(e) Requisitions on which price is desired to be marked "Price" with the serial number of the inquiry. This inquiry, after being checked to the original requisition, becomes a memorandum requisition or tabulation and business is awarded on this memorandum or tabulation according to prices received and properly approved by the purchasing officer or his authorized representatives.

All requisitions on which the material has been ordered, as well as requisitions from which memorandum requisitions or price inquiries have been made, or requisitions on which items have been cancelled, may be filed in chronological order in loose leaf binders, arranged by requisitioning point. Other divisions or rearrangements of this file may be made as required to meet the conditions on the various railroads.

8—Orders, Preparing and Issuing. Orders are written on standare form from properly approved requisition as described in 7-A, B, C, D, and E. Orders to bear the following information:
(a) Number.
(b) Date.
(c) Reference to requisition.
(d) Complete description of material.
(e) Date of quotation or contract reference.
(f) Point of free delivery.
(g) Shipping directions and routing instructions.

It was suggested that date of quotations only be shown on original order to seller, this making it necessary for the seller to check up the quotation before entering the order, also protecting both buyer and seller in the event order is mismailed; the price as well as the date of the quotation to appear only on the office copy. Orders issued without price as described in 7-D should bear notation to advise price. Orders placed by tele-

graph or telephone should be covered by confirming order with notation to that effect. Copies of orders may be filed:

(a) As per class of material account arranged alphabetically by firms and numerical order.

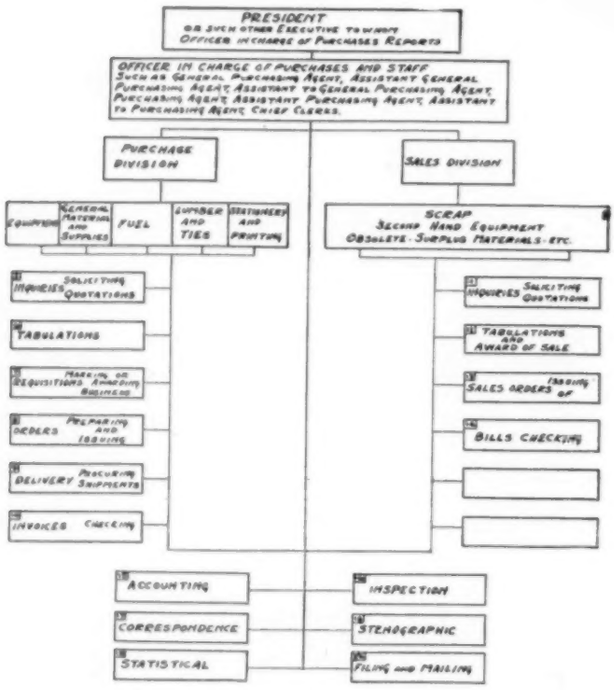
(b) By firm names alphabetically.

(c) Order number arranged numerically.

(d) Separate files may be maintained for completed and uncompleted orders.

9—Delivery—Procuring Shipments. Delivery of material to be urged at regular intervals, keeping in mind, of course, promises of delivery made when business was awarded. When proper results are not obtained by telephone, telegrams or letters, personal visits should be made to expedite delivery.

10—Invoices, Checking. Invoices on which a cash discount is allowed to be sorted and handled for special payment. Invoices to be checked to insure correctness of all details and after verification of prices, etc., sent proper party for certification as to



Office Organization of a Purchasing Department

the receipt of material. A copy of invoice should be retained and may be filed alphabetically by firm name with further subdivisions and arrangement as may best suit the requirements.

Sales Division

11—Inquiries, Soliciting Quotations. Inquiries to be prepared at stated periods listing materials for sale with a specified time allowed for reply.

12—Tabulations and Award of Sale. Tabulations to be prepared showing the quantities offered for sale, firm name, date of bid, price and quantity bid and point of free delivery, and such other information as may be desired. Tabulation indicating most favorable bid to be submitted to the proper officer or his authorized representative for review and award, and the successful bidder notified of acceptance.

13—Sales Orders, Issuing of. Sales orders to be forwarded to department head interested and record maintained for checking shipments, showing date, car number, initial, quantity, classification, etc.

14—Bills, Checking. Bills to be checked to insure correctness of details and after verification of prices, etc., placed in proper channel for collection.

General Remarks

A list of firms should be maintained showing name and address, credit rating and on what basis material will be sold, whether on credit or C. O. D. bids, acceptances and shipping instructions may be filed separately for each month, alphabetically by firm name or by assigning each a number and file numerically.

15—Accounting. Where it is desired the accounting incident to handling of invoices, preparation of vouchers, debits and credits because of adjustments, etc., be performed by the purchasing department in accordance with rules and regulations of the accounting department.

16—Inspection. The inspection of material to be in accordance with terms of sale, and in the case of scrap in accordance with the standard classification.

17—Correspondence. Correspondence pertaining to adjustments, cancellations, rejections, shortages, overshipments, etc., may be attended to by the section handling that particular class or may be handled as a separate unit.

18—Stenographic. Except in special assignments of secretaries to officers and where it is found economical to have stenographers do certain other lines of work a division or group should be formed comprising stenographers and transcribing machine operators. Dictating machines should be used for all correspondence wherever practicable.

19—Statistical. This section to prepare all information of a statistical nature.

20—Filing and Mailing. The file and mail section may be combined as there are many points of similarity in this work. All incoming and outgoing mail and the distribution and collection of all mail throughout the office together with correspondence files both active and inactive should be handled by this section.

Standardization—Basis for Efficient Purchasing

The committe was requested to prepare a recommendation on this subject, and submitted the following:

Division VI, Purchase and Stores, have the contact with manufacturers or producers and should know standards and their prices. They provide a store stock of from 40,000 to 70,000 different items and know the relative demands as to sizes and grades. In order to maintain the number of items in store stock at a minimum, and to purchase at lowest prices, they should advise the using departments as to standards, relative prices, etc., and to collaborate with these departments in standardization.

Committee: C. E. Walsh (Penna.), chairman; G. W. Bichlmeir (U. P.), C. R. Craig (Sou.), L. Lavoie (C. N. R.), A. W. Munster (B. & M.), W. G. Phelps (Penna.), chairman *ex-officio*.

Discussion

W. E. Lefaivre (D. & R. G. W.): What action is taken by the various roads in connection with discounts, for the time elapsed before delivery of material has actually been received and counted in the stock by the storekeeper.

C. E. Walsh (Penna.) Chairman: On a great number of railroads, it has been found that they pay invoices on which there is a cash discount before the material is actually delivered, provided of course it is a regular source of supply and what is known as a reputable concern. Some railroads, if they have a bill of lading with the invoice, will pay. Others do not require the bill of lading.

Mr. Lefaivre: What stamp would your storekeeper put on that invoice in furnishing the invoice to the auditors for payment? Would it show that the material was not received or was received.

Chairman Walsh: That is a detail that depends entirely on how the accounting is handled or the issuing of vouchers, whether through the accounting department or by the purchasing department. In some railroads where it is handled through the purchasing department they pay on what is sometimes referred to as the duplicate or triplicate invoice and the original is sent around for signature as to receipt of material and matched up when it is returned to the purchasing office, or the accounting department.

(*The report was accepted by the Division.*)

Report on Reclamation of Discarded Material

The report of the Committee on Subject 3 offers an interesting and excellent illustration of the application of a scientific and detailed study to the reclamation of material ordinarily considered scrap. In the part of its report devoted to suggested practices it presented 11 items which have been investigated by the committee through a questionnaire and found by a varying number of railways to be a profitable procedure. Included in these, and apparently the ones offering the greatest possibility of substantial savings, are the grinding of slid flat cast iron wheels and the reclamation of metal freight car roofs. The report presented some figures on comparative costs on comparable operations, but stated that such figures are difficult to secure as there is little reliable cost data available.

H. C. Stevens
Chairman

It was the committee's recommendation that the title of Subject 3 be changed to "Recovery, Repairs and Reclamation of Discarded Material, Classification and Handling of Scrap." It recommended that all recovery, repairs and reclamation be done at local points, so far as is economical and there is use for the material in that immediate territory; that the education of all employes at local points to this end be more prominently featured. It further recommended that all repair and reclamation work at local points be done on store orders; that costs be carefully studied to compare with practices at central reclamation docks and determine if practices being followed are real savings. Inquiry develops that cost records are not being generally maintained.

Suggested New Practices

The following items have been investigated by questionnaire on 83 Class 1 railroads, of which 51 roads replied; the result of the investigation follows:

No. 1. Grinding of Slid Flat Cast Iron Wheels. This practice is followed by eight railroads. None of these roads hauls beyond point necessary to press off for scrap. Cost per wheel for grinding, 90 cents to $1.44. This would indicate the possibility of substantial savings and it is recommended for investigation by railroads not following the practice.

No. 2. Reclamation of Driving Journal Compound. Our investigation developed that most roads are doing this by hand, picking dirt and foreign matter out of the old compound and repressing the cleaned quantity separately from or mixed with new. The cost of reclamation varies from 1 cent to 3 cents per lb. The general practice is to use this reclaimed compound only on freight and switch engines.

No. 3. Recutting Files. Twenty-four roads are having this done. Investigation shows that files properly recut give satisfaction in restricted service. It was recommended that where files can be secured properly recut at satisfactory cost, this be done.

No. 4. Retruing Journal Bearings. Investigation developed that 18 roads are using hand truing machines and 13 roads are using stationary boring machines for the retruing of journal bearings without rebabbitting. Saving can unquestionably be effected by their process, but the question of doing this work should be agreed to by the mechanical department before it is inaugurated.

No. 5. Reclamation of Metal Freight Car Roofs for Re-application. It is found that 13 roads are now doing this. The cost varies from $5.50 to $8 per roof. It is recommended that this be made general practice where the volume is sufficient to warrant, subject to A. R. A. rules.

No. 6. Carbide Refuse. It was found that roads having acetylene generating plants generally use the refuse in making whitewash. There are numerous mixtures for this purpose.

No. 7. Wiping Waste and Rags. Investigation developed that most roads are saving this for reclamation in different ways. It was recommended that wiping rags be saved and washed for re-use where practicable; that wiping waste be accumulated and thrown in with cotton dope except where roads using wool dope consider it injurious; that in this case it be accumulated and renovated for re-use.

No. 8. Regrinding Raceways of Bearings for Headlights, Turbines and Generators. Investigation developed that 14 roads are doing this. Some have tried and discontinued it. By proper inspection and supplying manufacturers with templets, these bearings can be suitably re-ground for further service. Costs so far as obtained. indicate a saving of about 80 per cent. and that 100 per cent. service is obtained.

No. 9. Regrinding Raceways of Bearings for Electric Locomotives. It was found that some roads are successful in having the large ball bearings reground.

No. 10. Welding Lugs on Oil Boxes. Investigation developed that 17 roads are doing this successfully and profitably. The cost varies from 59 cents to $1.05 each.

No. 11. Torn or Ripped Cement Sacks. Twenty-eight roads are returning these to cement companies and securing satisfactory credit. It was thought that generally more value will be secured in this manner than in otherwise disposing of these sacks. As the sacks generally cost cement companies more than is charged to us for them, they are equally interested in reclaiming. The minimum credit should be price charged, less cost of repair.

Items for Information Only

No. 12. Reclaiming Angle Bars and Rail Joints. A few roads are doing this. Some are only straightening bent units. Some are planning bars suitable for use with smaller rail sections. Others are building up worn places by autogenous process. A very few have installed furnaces and reclamation machinery by which they heat and re-form these when the wear does not exceed certain limits. Costs vary from 17½ cents to 62 cents per pair. It was thought that where the volume warrants, equipment should be installed with which to do this reclamation to the maximum extent economical. One railroad has installed such a plant with a discarded wheel press.

Reclaiming Car Roofs—Machine For Trimming the Head End

No. 13. Boiler Lagging. Practically all roads are doing this. The majority are using in plastic form and using no binder. A few are using wood slabs, one railroad using shavings.

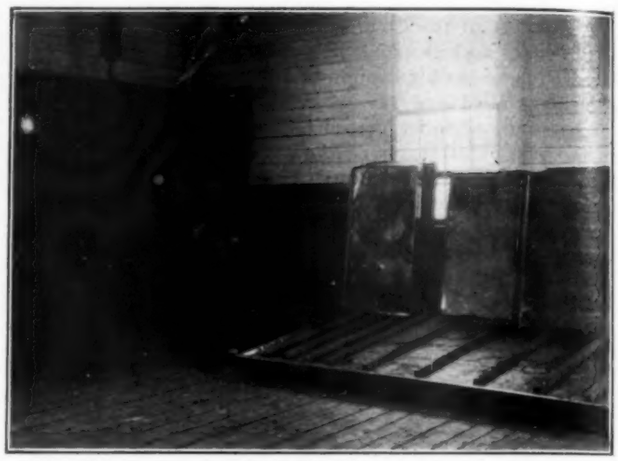
No. 14. Bushing and Boring Motor Car Cylinders. Investigation developed that 7 roads bore and bush; 12 roads bore and apply over-sized pistons and rings. The committee was unable to secure any definite information as to costs. Replies indicate that by either process there is a possible saving of 50 per cent. as compared with the purchase of new cylinders, with equal service.

No. 15. Arch Brick Refuse. Some roads are saving arch brick refuse for grinding and mixing with cement and using same moulded into new bricks or in plastic form in lining furnaces. On account of the heat to which this refuse has been subject it is considered by some of higher quality than new brick. This is still in the experimental stage but unquestionably has some merit.

No. 16. Discarded Canvas. In addition to using worn canvas and clippings for patching purposes as previously reported, the following uses are made of same: Making of canvas buffing wheels; protection pieces under roof caps metal car roofs; to line refrigerator car doors; application to dust guards; loco steam pipe covering; and aprons for workmen.

No. 17. Rubber and Composition Boots. Reclamation of these has been extended very little, apparently due to lack of proper control after reclaimed. It was thought that if all rubber boots were kept from service where oil or hot cinders are encountered, as at roundhouses and cinder pits, and only composition boots furnished, for this purpose, both or either can be profitably reclaimed.

No. 18. Water Treating Plant Refuse. The question of sludge from water softening plants was investigated. In one or two cases this is given to agriculturists for fertilizer. The committee was unable to develop any other possible use.



Dipping, Draining and Drying Reclaimed Car Roofing

Classification of Scrap

Cost of Handling Scrap. Investigation developed that comparative costs for entirely comparative operations are very difficult to secure. Information obtained indicates the following costs per net ton unloading, sorting and reloading under the different handling methods.

	Road					
Method	A	B	C	D	E	F
Gantry Crane	$0.50	$0.76	....	....	....	....
Locomotive Crane	0.60	0.68	$1.00	$1.50	$0.90	$0.85
Hand Labor	1.21	0.96	1.00	1.83	1.46	....

The figures clearly indicate the desirability of some reliable cost data. It was recommended that all roads compile data per net ton cost handling of scrap, excluding brass, metals, wheels, axles, rails, based on handling payroll, supervision, clerical help, supplies, heat, light, air, other power, miscellaneous expense, including cost of maintaining and repairing machinery, and labor furnished by other departments, all actually applicable to the scrap represented; this cost to be totaled for a period of not less than six months and divided by the total net tons of scrap disposed of during the period by sale, reclamation or recovery, each item to be set up separately so far as practicable.

The committee was not unmindful of the far reaching economy resulting from the use of scrap service cars in accumulating scrap or reclaimable material at outside points for shipment to a central sorting station. The use of these cars results not alone in economy in the use of revenue equipment, but lessens the labor in handling the material at point of origin.

The committee was also in favor of handling scrap accumulations on the ground without the construction of any concrete or wooden platforms, bins, partitions, etc. On a representative railroad where scrap service cars handle over 90 per cent. of the receipts, at one yard, where the entire accumulation is dumped and sorted on the ground without the use of bins, buckets or similar devices, a careful check disclosed the fact that scrap is being handled in and out efficiently and expeditiously at the rate of less than 50 cents per ton.

General Layout of the Shop for Reclaiming Car Roofs

Charges for Classification

Classifications Nos. 7 and 8. Is was recommended that scrap Classifications Nos. 7 and 8 be consolidated to read as follows: No. 7—Angle and Splice Bars. Steel Angle Bars, Splice Bars and Patented joints.

Classification Number 15. Present classification reads as follows: No. 15—Cast, Railroad No. 1. Pieces weighing 150 lb. or less, includes new grates, new stove plate and clean cast-iron culvert, soil and water pipe to be free from brake shoes and burnt grates, burnt grate frames, burnt stove plate and all other burnt castings. Proposed change: Insert in brackets after words, "to be from brake shoes," the words "Except all Cast." Eliminate, "and burnt grates, burnt grate frames, burnt stove plate and all other burnt castings," and substitute instead, "and all burnt castings."

Classification will then read: No. 15—Cast, Railroad No. 1. Pieces weighing 150 lb. or less, includes new grates, new stove plate and clean cast-iron culvert, soil and water pipe, to be free from brake shoes (Except all Cast), and all burnt castings.

Classification Number 43. Present classification reads as follows: "No. 43—Sheet Scrap No. 2 and Miscellaneous. Includes netting, other than stackwire; all galvanized or tinned material, composition brake shoes and gas retorts, and any other iron or steel material not otherwise classified." Proposed change: Eliminate "and any other iron or steel material not otherwise classified."

Classification will then read: No. 43—Sheet Scrap No. 2 and Miscellaneous. Includes netting, other than stackwire; all galvanized or tinned material, composition brake shoes and gas retorts.

Committee: H. C. Stevens (Wab.), chairman; D. B. Allan (U. P.), C. B. Hall (Penna.), L. V. Guild (O. S. L.), F. S. Peck (C. M. & St. P.), C. K. Reasor (Erie), C. B. Tobey (L. V.), A. S. McKelligon (S. P.)

Discussion

E. W. Peterson (B. & A.): What I would like to know is whether you would charge out reclaimed material at the percentage value of new, or would you charge out reclaimed material at the price of new, as it would affect operating expenses?

H. C. Stevens (Wab.) Chairman: The practices as to the value at which reclaimed material shall be charged out, as compared with the prices of new, vary on the different roads. The majority seem to use the practice of charging the reclaimed material at the price of new.

Mr. Peterson: If you charged out the value of new and it only cost you, for instance, 60 per cent., aren't you inflating the operating expenses?

Chairman Stevens: Not if you give operating expenses the credit for the difference between the value of new and the scrap value plus the cost of reclaiming that article, which those roads do who charge it out at 100 per cent.

J. W. Gerber (Sou.): In Paragraph 3 is something which seems to me to be the most important part in the whole report, that is where you state the scrap is handled in and out. I assume that means unloading, assorting, cutting apart in different classes, and loading out at fifty cents a ton. Do you include all of your scrap regardless of whether it is scrap that you have to assort and cut apart, or do you take your whole scrap accumulation like cast wheels, and steel wheels and tires, and such stuff as that that you don't have to assort?

Chairman Stevens: On account of the short time in getting in the report, we were unable to determine as we wish to just what scrap this cost comprised. Apparently it covers all scrap handled at that yard and primarily they handle at that yard the heavier scrap and it does not include all of the scrap accumulation on the railroad.

W. L. Hunker (C. R. I. & P.): I note that the committee is asking for suggestions about the doubling up of Classifications 7 and 8. I should like to ask the reason

Chairman Stevens: Several roads recommended this combination. A canvass indicated that a vast majority were in favor of the combination because they had not been able to gain any advantage by the separation. The committee felt its duty was to endeavor to serve the larger number, consequently the recommendation for the change.

(*The report of the committee was accepted by the Division.*)

Report on Classification of Material

The committee presented at the 1922 meeting of the Division, a complete revision of the standard material classification, listing practically every article used in all departments of the railways. Over 4,000 items were included in the classification. The report of the committee this year forms a check on the railways to ascertain to what extent the revised classification is being used. This was done by means of a questionnaire sent out to 86 roads. The results showed that 43 roads out of the 86 are using the revised classification; 23 roads are still using the old classification but will change as conditions warrant. A review of the replies indicates that no changes should be made at the present time, minor corrections being made by the roads interested.

W. L. Hunker
Chairman

The committee has canvassed through the secretary's office and personally by members of the committee, the various railroads as to the general use of the revised classification. Eighty-six roads have replied, comprising 233,273 miles of track in the United States and Canada. Of this number, 43 railroads, representing 102,953 miles are now using the classification revised in 1922, 23 railroads representing 46,800 miles are still using the old classification, 18 railroads representing 78,958 miles are using classifications developed by themselves, and 3 railroads representing 4,595 miles, have no classification whatever.

Of the 23 roads using the old classification, the replies indicate that as conditions warrant, they will change to the standard revised classification. Of the 18 roads having classifications of their own, some are very similar to the standard revised classification, while others are more or less elaborate. The largest of the three railroads having no classification, states that if a classification is adopted, it will be the standard revised classification.

A review of the replies, especially from the 43 railroads now using the revised classification, indicates they are not in favor of any changes at this time. In fact, they are of the opinion that the present classification should be allowed to remain in effect

to avoid the distortion of comparisons, costs of making the various changes, and education of their office forces and others.

News Items—Automatic Train Control

In reviewing items which are not shown in the present classification, the only item of importance is the Automatic Train Control. The committee recommended that all material peculiar to the roadway sections of the automatic train control be incorporated in Class 2-A, while material peculiar to locomotives, should be included in Class 23-B. All materials for automatic train controls (whether roadway or mechanical), that are common to other work, should be left in the classes to which they are now assigned.

Corrections

The committee found a few items that are apparently misclassified in the present classification, but the number of these, together with their value is very small, and in view of the fact that they have been taken care of locally by the railroads interested, it did not believe it advisable at this time to suggest any corrections.

Committee: W. L. Hunker (C. R. I. & P.), chairman; J. J. Bennett (I. C.), J. C. Jackson (G. T.), O. B. Mills (Penna.), W. H. Morris (Reading), G. P. Turner (Sou.), E. H. Hughes (K. C. S.), chairman *ex-officio*.

(*The report was accepted by the Division.*)

Report of Joint Committee on Fuel Conservation

Since the Joint Committee on Fuel Conservation reported at the last annual meeting of Division VI, it has held two meetings at which considerable progress was made. No new lines of work have been taken up by the committee. A plan contemplating the establishment of a research bureau has been approved and forwarded to the president of the A. R. A.

Samuel Porcher
Vice-chairman

One of the problems which this research bureau can take up is that of establishing a definite ratio for equating coal and oil as fuel for use in statistics for the Interstate Commerce Commission. At the last meeting the committee considered the adoption and issuance of booklets on fuel and related economies and approved of three now already prepared.

The committee reported progress with the subjects which have been before it for the past year or two. No new line of work has been taken up by the committee. It will be recalled that the Joint Fuel Conservation Committee has been co-operating with a special committee of the International Railway Fuel Association, and has been working, also, with members of the faculty of the University of Illinois and Purdue University.

The plan for establishing a central agency for the investigation and testing of fuel, and the development of fuel-saving practices, has been approved and has been submitted to R. H. Aishton, president of the American Railway Association for his information. This plan contemplates the appointment of a research director and a bureau under him. The expense of maintaining such a bureau has also been estimated and submitted.

In the second place, it will be recalled that there has been under consideration the establishment of a definite ratio for equating coal and oil as fuel This definite ratio of fuel oil equivalent to one ton of coal is for use in statistics which must be submitted to the Interstate Commerce Commission by railways using fuel oil, and in other cases where a standard comparison is to be made between the two kinds of fuel. There are other problems also which the research director can take up under this general question of the most economical methods of using fuel.

In the third place, the committee, at its last meeting in Chicago, took under consideration the adoption and issuance of booklets on fuel and related economies, to be published by the American Railway Association for distribution on American railroads, and approved of Booklets Nos. 1, 2 and 3, which have been prepared with the help of the International Railway Fuel Association, and which are intended to add to the interest now taken by railway officials and employees in the effort to use fuel most economically.

A new questionnaire was also decided upon, which is to be submitted to the railroads for the purpose of learning their practices for economizing fuel and the progress they may have made in carrying out those practices.

Committee: S. Porcher (Penna.), vice-chairman; Thos. Britt (C. P. R.), H. B. Grimshaw (S. A. L.), L. N. Hopkins (C. B. & Q.), G. E. Scott (M. K. T.), R. C. Vaughan (C. N. R.), S. B. Wight (N. Y. C.).

Discussion

The Chairman introduced M. A. Daly, chief fuel supervisor of the Northern Pacific, who for the past year has been president of the International Fuel Association. J. B. Hutchinson, secretary, and J. M. Nicholson, supervisor of fuel of the Sante Fe.

The Chairman: We would like to hear from you gentlemen on this report, or on any matters that you can bring to us that will be of interest at this time this being a joint committee report.

Mr Daly: When you consider the buying of a ton of coal, you don't buy pounds, when you analyze that question; you don't buy quantity; you buy energy; the amount of work that that ton of coal will do at the draw-bar is the value of that coal, not the weight of it. So that it seems perfectly natural to emphasize that, when I can tell you in a single illustration that I know of two coals used on the same locomotives, one coal having a b. t. u. value of 12,500, the other of 11,000, and both of those coals will steam well on the same locomotives. The 11,000 b. t. u. coal is nearly one-quarter better than the 12,000 b. t. u. coal. That is because of the peculiar physical characteristics of the coal, the burning possibilities. If an engine failure occurs, is it poor coal? Is it an engine failure? Is it a purchasing failure? When you buy steel, for instance, you don't just specify steel. Nowadays you go into details of quality and chemical analysis to be sure that you buy the article that is right for what you want to use it. So the time has come when you are going to buy coal not alone by its chemical analysis but by the peculiar characteristics of which it is composed, and which allow it to transfer heat into the water.

That idea of the different quality of coal refers me back to the University of Illinois which in 1917 at the initiative of the International Railway Fuel Association conducted a series of tests to develop the efficiency of various sizes of coal on the same locomotive. There was a difference of nine per cent in the efficiency of the same coal. I need mention only that to show you that there is unlimited policies of developing efficiency by considering the various services, the various types of locomotives, the various coals available, and the various sizes of the different coals. Those are things which are in embryo and it seems most emphatic that this is the time to congratulate you for your opportunity to develop that co-operation in these great possibilities which promise remuneration.

Mr. Nicholson: This section of the American Railway Association has a very important part to play in fuel conservation. The purchase of railway fuel is where conservation begins and it ends with the economical utilization of power generated from fuel. Fuel is the largest item of cost under the jurisdiction of the purchsaing department, and each railroad must determine by test their most economical fuel from a standpoint of consumption consistent with cost. The lowest cost per 1,000 gross ton miles for fuel is not always secured from the fuel lowest in price per ton. Consideration must be given the producer who has a good quality of coal that is properly prepared as to size and removable impurities. The distribution of fuel of a uniform quality to each operating division is important. This will permit the drafting of locomotives to get the most work out of the fuel consumed.

Mr. Aishton, in his address to the International Railway Fuel Association, and in his addresses to the sections of the A. R. A., asked that each of us set as an objective that we will save a pound of fuel for every 1,000 gross ton miles hauled. This section can more than accomplish this objective by making a thorough investigation of their available fuel, and be guided in the purchase of fuel by the results of these tests which establish relative performance that can be secured from the different fuels.

(*The report of the committee was accepted by the Division.*)

Election of Officers

The following officers were elected for the ensuing year:

Chairman, A. W. Munster, Purchasing Agent, Boston & Maine; and Vice-Chairman, C. D. Young, Stores Manager, Pennsylvania System.

The following members were elected to serve on the General Committee for two years: U. K. Hall, General Supervisor of Stores, Union Pacific System; L. Lavoie, General Purchasing Agent, Canadian National; C. E. Walsh, Assistant Purchasing Agent, Pennsylvania System; R. J. Elliot, Purchasing Agent, Northern Pacific; H. H. Laughton, Assistant to Vice-President (Operation), Southern System; W. Davidson, General Storekeeper, Illinois Central; and J. G. Stuart, General Storekeeper, Chicago, Burlington & Quincy.

The members of the Nominating Committee elected for one year are as follows: C. D. Young (Chairman), Stores Manager, Pennsylvania System; H. H. Laughton, Assistant to Vice-President (Operation), Southern System; E. W. Thornley, Assistant Purchasing Agent, Baltimore & Ohio; J. F. Marshall, Purchasing Agent, Chicago & Alton; and W. Davidson, General Storekeeper, Illinois Central.

(*The Division VI was adjourned.*)

Newly Elected Officers of the P. & S. Division

THE PURCHASING AND STORES DIVISION yesterday elected August William Munster, purchasing agent of the Boston & Maine, as its chairman, and C. D. Young, stores manager, Pennsylvania System, as vice-chairman.

Mr. Munster has always taken an active interest in the work of the association, as well as in other railroad organizations. He was recently elected president of the New England Railroad Club. Mr. Munster was born at Wal-

A. W. Munster, the Newly Elected Chairman of the Purchases and Stores Division

tham, Mass., July 24, 1882, and was graduated from the Massachusetts Institute of Technology in 1904. He served a special apprenticeship on the Northern Pacific Railway and then worked as a machinist and also in the department of tests and inspection of materials on that road. From 1909 to 1911 he was chief inspector and engineer of tests of the New York, New Haven & Hartford. He went to the Boston & Maine in 1912 as general storekeeper and since 1917 has been purchasing agent of that road.

C. D. Young has been an active and constructive worker in many technical organizations and since he has been in the stores department has been active in the P. & S. Division. He was born on May 19, 1878, at Washington, D. C. He is a graduate of Cornell University and on June 25, 1900, entered the service of the Pittsburgh, Cincinnati, Chicago & St. Louis as a special apprentice. In July, 1903, he was promoted to erecting gang foreman, and on October 16, 1903, became machine foreman. He was promoted to assistant motive power inspector on January

1, 1905, serving in that capacity until May 1, 1906, when he was transferred to the Pittsburgh, Fort Wayne & Chicago. In September, 1906, he returned to the Pittsburgh, Cincinnati, Chicago & St. Louis as assistant engineer of motive power, and on June 1, 1910, assumed that office under the general superintendent of motive power of the Pennsylvania Lines west of Pittsburgh. On October 1, 1911, he became engineer of tests in the office of the general superintendent of motive power of the Lines East, and on May 9, 1917, was promoted to superintendent of

C. D. Young, Newly Elected Vice-Chairman of the Purchases and Stores Division

motive power of the Philadelphia, Baltimore & Washington, with headquarters at Wilmington, Del. In November, 1918, Mr. Young was commissioned a lieutenant-colonel in the Transportation Corps, Engineers, of the United States Army and in January, of the following year, was appointed acting superintendent of the Schuylkill Division of the Pennsylvania, with headquarters at Reading, Pa. At the termination of federal control he was appointed superintendent of the Schuylkill division, with the same headquarters and shortly afterward was appointed general supervisor of stores, with headquarters at Philadelphia. In January, 1924, he was given the title of stores manager, his headquarters remaining at Philadelphia.

Registration, American Railway Association

Division V—Mechanical

Currie, H. A., Asst. Elec. Eng., N. Y. C.
Bentley, W. F., Insp., B. & O., Pennhurst.
Burns, R. C., Asst. Eng., Penna., Haddon Hall.
Crawford, J. B., Asst. G. M., Pac. Fruit Ex. Co.
Cullingford, J. E., G. F., Penna.
Davenport, J. E., Supt. Fuel and Loco. Perf., N. Y. C., Ambassador.
Fackler, E. M., Asst. G. C. Insp., P. & R.
Felton, Chairman of Board, U. T. L., Ritz-Carlton.
Galloway, W. S., B. & O.
Hengstler, John, Supvr. Welding, Penna.
Kinney, F. G., Ch. Cl., P. & R.
Lenty, W. L., Asst. Engr., N. Y. C.
Miller, F. C., G. F., Penna.
Rankin, W. E., For. C. S., P. & R.
Staley, H. F., G. F., N. & W.
Wood, G. H., Gen. Air Brake Inspr., A. T. & S. F.

Division VI—Purchases and Stores

Blizzard, Asst. Storekeeper, Penna.
Dickenson, Storekeeper, Penna.
Logan, W. B., G. S., C. N. R.
Millar, H. N., Penna.
Reasor, C. K., Asst. Mgr. Stores, Erie.

New Devices

High Speed Drilling Record

With the idea of showing railroad men what can be accomplished with modern high speed drills, the Cleveland Twist Drill Company made arrangements for testing its new Cle-Forge drills at the convention this year. Owing to the high capacity of these drills it was found necessary to use a special drilling machine designed for this purpose by the Foote-Burt Company, Cleveland, Ohio. Some idea of the capacity of this machine may be gained from the fact that it is equipped with a 70-hp. driving motor and is designed to drive a 3-in. high speed drill to destruction. The results secured in tests are shown in the table, an examination of which will indicate how greatly they exceed those obtained in normal railroad shop operation. The feeds and speeds indicated are not recommended for common use but plainly show the reserve capacity of the drills, and, by indicating to railroad men what can be accomplished, they serve as a measuring stick for railroad performance.

Progress in the manufacture of high quality drills is plainly indicated by a comparison of the records shown in the table with those obtained in a similar series of tests conducted by the Cleveland Twist Drill Company, in June, 1911. A comparison of the 1911 with the 1924 figures will be of interest. In 1911 the Paragon 1¼-in. high speed drill penetrated only 25 in. per min. in cast iron, whereas reference to the table shows that the 1¼-in. Cle-Forge drill made in 1924 has a penetration of 116 in. per min. The relative feeds and speeds used in these two tests are .05 in. per rev., and 500 r. p. m. in 1911 as compared with .145 in. per rev. and 800 r. p. m. in 1924. Other tests in machinery and alloy steel showed similar results.

Rate of Penetration in in. per Minute Secured with Cle-Forge High Speed Twist Drills at Atlantic City, June 11 to 18, 1924

	Rate of penetration per minute in		
Size of drill	Cast iron	Machinery steel	Chrome nickel, Brinnel No. 250 to No. 255
⅝ in.	53 in.		
⅞ in.	75 in.	30 in.	3.9 in.
⅞ in.	85 in.	30.8 in.	4.04 in.
1 in.	116 in.	50 in.	5. in.
1¼ in.	116 in.	44.8 in.	4.3 in.
1½ in.	61 in.	19 in.	3.67 in.
1⅝ in.	52.2 in.	20 in.	3. in.
2½ in.		11.3 in.	
3 in.		7.8 in.	